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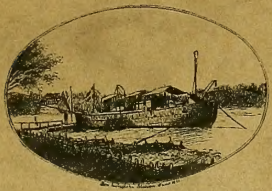
Report

of

The Danish Biological Station

to

The Home Department.



IV.

1893.

By

C. G. Joh. Petersen,
Ph. D.

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1894.

Professor Th. N. Gill. M.D. – Ph.D

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FOR
DEN DANSKE BIOLOGISKE STATION.

From

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On the Biology of our Flat-fishes

and on

The Decrease of our Flat-fish Fisheries

with some observations showing *how to remedy the latter*
and *promote* the *Flat-fish Fisheries* in our seas East of the Skaw.

C. G. Joh. Petersen.

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Awarded a prize by *Det kongelige danske Videnskabernes Selskab.*

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Introduction.

In the autumn 1891 I was commissioned by the Danish Home Department, as Director of the Biological Station, to make investigations into the conditions of our Flat-fishes and Flat-fish fisheries, in order to elucidate and eventually to answer the following questions, on the basis of these investigations, as far as the Danish Seas are concerned.

No. 1. Where, and to what extent, is any destruction going on of »immature«, particularly unmarketable flat-fishes?

No. 2. Which size limit ought to be fixed for flat-fishes that may be taken ashore?

No. 3. Is it desirable to give regulations fixing the size of the meshes of the various sorts of fishing-gear, used for the catching of flat-fishes?

No. 4. Is it considered serviceable to forbid trawl fishery for certain periods, at certain seasons and fishing-places?

No. 5. How are such regulations to be formulated?

The answers are briefly as follows:

Ad No. 1. *Unmarketable flat-fishes are caught* to a great extent in the Limfjord and on the sea-shores of the northern Jutland, at the former place with *eel-handseines,* at the latter with *ammodytes-seines.* How great the *destruction* is, depends very much on the discretion of the fishermen.

Real *destruction* of larger, though not sufficiently grown-up (»immature«) flat-fishes is not known to take place to any considerable extent.

Ad Nr. 2. Can be *exactly* decided only by experiments; it may be said, however, that the size limits scarcely ought to be under the following:

For **Plaice** 8 inches to the base of the caudal fin, in the Cattegat rather 10 inches, and in the Limfjord probably 12 inches.

For **Turbots** 12 inches to the base of the caudal fin.

For **Brills** 12 inches to the base of the caudal fin.

For **Soles** 10 inches to the base of the caudal fin.

The other flat-fishes (with the exception, perhaps, of the *halibut*) are partly too delicate to be protected in this way, partly of no moment to our fisheries in the main, and ought to be protected only by special regulations for the smaller seas; sometimes it will scarcely agree with Danish interests to protect them in any way.

Ad No. 3. No, not as a rule, as far as *our* fishing-gear is concerned. (Trawl I do not know from personal observation).

Ad No. 4. To judge from foreign statements on this matter it will most likely be serviceable to forbid the use of trawl, at any rate certain forms of it, in the seas east of the Skaw. The condition of the bottom, however, seems at most places to render such a prohibition superfluous.

Ad No. 5. *Plaice* under 8 inches (10—12 inches), *turbots* and *brills* under 12 inches, *soles* under 10 inches (all measured from the tip of the snout to the base (root) of the caudal fin) may not be taken ashore (or sold), but must be thrown into the sea again when they are caught, as soon as possible and, if possible, without impairing their vitality.

How far mere local interests may ask for exceptions, for the .protection of the little fishery at places where the *plaice* is particularly small, is not a question that can be decided by these investigations only.

With regard to the other flat-fishes we can think of such exceptions only with reference to the *turbot* at Bornholm.

The above prohibitions against the landing of fish under the size limit must be modified as far as ground-seines (ammodytes-seines, etc.) are concerned, so that these fish are to be thrown into the sea again as soon as possible and, if possible, without impairing their vitality. —

I do not think that these answers contain the means of raising our flat-fish fisheries to the highest pitch to which they may be raised by good laws. This is a goal which, for many reasons, can scarcely be reached as yet for a long while; but I do believe that, if we could get an international law, as nearly as possible consistent with these answers, and practically kept in force in the seas east of the Skaw (to which seas my investigations have been limited), our flat-fish fisheries in the main would be considerable better off. I do believe also that it will be necessary to suffer the fish to grow to a larger size even than I have here proposed, in order to get the greatest possible profit on these fisheries in the future. Whether we can reach the goal in this way will be shown by future statistics; that it is the right way, certainly, and that we cannot any longer content ourselves by *hoping* that our flat fish fisheries will soon flourish again, is a fact of which I hope the following data will convince at least some of my readers.

Copenhagen, March, 1894.

Later *Note:*

When the whole of this treatise was written, and the greater part of it had gone through the press, my assistant Mr. *Th. Mortensen,* through continued investigations, succeeded in proving the occurrence of pelagic eggs in the deep, *saline* water at Bornholm, most probably the eggs of turbots and plaice. Some more young plaice, under 2 inches in length, in all upwards of twenty, were found also at Bornholm. It is thus probable that turbots and plaice, exceptionally, may be developed from eggs in this saline water in years when such water is found at Bornholm. Cmp. my statements, pp. 10—11 & 27 on the propagation of the plaice, and p. 43 on that of the turbot in the Baltic Sea.

For information on the changing salinity on deep water at Bornholm I shall refer to Professor *O. Petterson's* hydrographical works in Kgl. sv. Vetenskaps Academiens Handlingar. —

This interesting find will be more closely discussed in a following report; I just mention it here, because it gives an additional proof of the necessity of salinity or rather of a certain specific gravity of the water, if the pelagic eggs are to be developed, and because it supplements my investigations into these matters.

Chapter I.

On the occurrence of flat-fishes, and on some other biological conditions, concerning these fishes, in the seas east of the Skaw.

15 species of *flat-fishes* are known in our seas east of the Skaw:

1) *Pleuronectes platessa.*
2) — *flesus.*
3) — *limanda.*
4) — *microcephalus.*
5) — *cynoglossus*
6) *Hippoglossus vulgaris.*
7) *Hippoglossoides* or *Drepanopsetta platessoides.*
8) *Rhombus maximus.*
9) — *lævis.*
10) *Arnoglossus laterna.*
11) *Zeugopterus norvegicus.*
12) — *megastoma.*
13) — *punctatus.*
14) *Solea vulgaris.*
15) — *lutea.*

During these researches only one specimen of No. 15 has been found. Formerly I have found four others, at Frederikshavn 1884. No. 10, which has hitherto been looked upon as a rare fish in our seas, was found in considerable numbers, but it is so small and of so little value as food for man, that it cannot be taken into consideration in an eventual law.

Nos. 11—12—13 are so rare, and so small too, that they are of no value as human food.

All the others are used as food for man, but only two species are the object of a special fishery, viz. *Pleuronectes platessa* and *Solea vulgaris*, the rest are taken only when they are caught by chance; among these it is particularly *Rhombus maximus & lævis, Hippoglossus vulgaris,* and *Pleuronectes microcephalus & cynoglossus* which are of a somewhat greater importance as a commodity, though also *Pleuronectes limanda & flesus* in some of our smaller seas may be sold at the local markets.

Of them all the plaice (Pleuronectes platessa) is by far the most important article of trade, and all our flat-fishfisheries are therefore in familiar language called *plaice-fishery*.

The Plaice (Pleuronectes platessa).

(With 9 tables).

We need not study the plaice in open nature very closely in order to perceive the striking *difference in the size of this species of fish in our various seas,* a matter with which every fishmonger is perfectly well acquainted. That the plaice in the Cattegat is sometimes very large, particularly on the deep sea, and that it is very small in the Baltic, is among fishermen a well-known fact; also, that the distribution of the fish within the same sea is such, that the large ones are found in certain regions, the small ones in other parts. Still more remarkable seems the fact that *ripe specimens of plaice are scarcely ever* seen in certain parts of the Cattegat, for instance at the Skaw, while they are often met with at Anholt. Also this is a thing with which the fishermen are well acquainted. — In order personally to get the opportunity of seeing a number of plaice in the breeding-time (winter) from different places east of the Skaw I bought a number of fish from the fishermen in the winter 1892, and examined their *size* (length)*) as well as the *degree of development or ripeness of their sexual organs.* — The result of these researches is represented in table I. When only so few small specimens are represented in this table, the reason is that the fishermen cannot catch such with the fishing-apparatus they employed. Which sizes the fishermen on the whole are able to get in their fishing-apparatus will be mentioned afterwards.

In table I **,** signifies that the fish are ripe or near the spawning, and that they must be supposed to be far from spawning-time. The 14 columns are *arranged geographically* from the Skaw, into the seas, as far as the Baltic (Rytzebæk and Stevns). In column 2—4 only fish *larger than* the statutory size limit (8 Danish inches to the base of the caudal fin, or c. $9^3/_4$ inches to the tip of the caudal fin) have been examined; in column 7 almost exclusively fish below this limit.

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*) When nothing else is said, the length is always understood as the distance from the tip of the snout to the tip of the caudal fin.

The table shows:

1) That »ripe«, i. e. spawning, fish are found everywhere, but only in very small numbers at the Skaw. — Nor were they very common in Læsø-Rende, but at Anholt, Grenaa, the Lesser Belt (Dyreborg, Ærø, and Skjoldnæs) as also south of Sealand they were frequently met with. These latter places are all situated on rather open shores and near deep water, none of them in fjords or low archipelagoes. (Comp. for instance the Chart of the Depths in »'Hauchs' Togter. Atlas«).
2) The smallest ripe spawner is 7 inches long, the largest ripe spawner nay indeed, the largest plaice in the table, is $22^1/_2$ inches. The smallest ripe milter is also 7 inches, but the largest ripe milter, and on the whole the largest milter, is only $18^1/_2$ inches. To know these extremities is however not of so great interest, as it is to know the *average size* of the plaice the first time they become ripe and, on the whole, the *average size* in the various seas of the mature (grown-up) fishes, i. e. those more than three years old*).

Also on these matters the table gives some information. I should wish this to be somewhat more complete, but so much is sure, that the mature (grown-up) plaice in the Baltic seems to have an average size of about 10 inches (not regarding the fact that the milters, on an average, are a little smaller than the spawners), in the *Lesser Belt* about 11 inches, and in the *Cattegat*, especially in the eastern part, 12—13 inches *at least*. On an average, then, they are larger in the northern and eastern parts of the Cattegat than in the Belts, and here again larger than in the eastern Baltic Sea. That the maximum sizes in the latter seas never reach those of the Cattegat is easily seen in the table; it is also evident that small, ripe fish, under 11 inches, are far more rare in the eastern Cattegat than in the Baltic; both these circumstances support the above observation on the average size — as, indeed, they ought to do. As to this matter I shall here say, that it is possible, certainly, through a sufficient number of observations to get a somewhat correct idea of the average size, but this is far more difficult to fix than the maximum or minimum size; therefore we had better always take all three sizes into consideration in order to avoid mistakes*).

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*) Marked 3 in the table.

With regard to size the plaice from the seas about the Lesser Belt, the Great Belt (see table II), and Grenaa, are between the plaice from the northern and the eastern part of the Cattegat, on one side, and those from the Baltic Sea, properly so called, on the other, the latter supposed to commence east of Sealand, Møen, and Falster. Whether this is simply because the *favourable natural conditions*, which may be supposed to regulate the size of the plaice, are just arranged in such a gradual succession from the Cattegat to the Baltic Sea, as, evidently, they generally are, or whether *the said decrease in size is owing to a migration of the plaice, as they grow larger, from the Baltic Sea and the Belts to the Cattegat,* I do not know for certain. There are good reasons, however, to think that the plaice of the Baltic Sea generally pass their pelagic larval stage in the Cattegat (or the Belts) and do not enter into the Baltic till they are about one year old (see later on); therefore we can scarcely speak of a *particular race of plaice* as a whole breeding, generation after generation, in the Baltic Sea; at most the question will be 1) whether the *single individual*, which has been born at another place, will remain in the Baltic Sea (or in the Belts) through its whole life, without surpassing the size which is the normal size here; or 2) whether the individual, when it approaches this size, goes farther northward where the large plaice are found, and not till it is there reaches a considerable size; or 3) whether both these processes may occur, sometimes one, sometimes the other. — However this may be, it is remarkable to see a great number of rather short fish becoming ripe in the Baltic and the Belts (as far north as Grenaa), while such are rarer in the northern part of the Cattegat (and the Limfjord).

Are we to think, perhaps, that also other brackish waters than the Baltic can check the growth of the plaice, and that, for instance, every little brackish fjord, where the young fish go up too far, has the same influence? This deserved a further examination, just as the immigration of *Pleuronectes flesus* into fresh water. I have repeatedly touched this question with respect to the lower animals and the herring. (More about this later on).

That of our seas where the plaice grows to the largest size, before it becomes ripe, is evidently the Limfjord (The German Sea has not been investigated by Danes). (See table V, column 1—2).

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*) It is a matter of course that mere exceptional or rare sizes are of no moment with respect to this question.

In the Limfjord, on the whole, ripe specimens are so rare that I am inclined to think that the plaice, as a rule, does not spawn in this fjord, but leaves it a short time before the spawning-period. There are found specimens, however, with strongly developed sexual organs, but I never saw them myself (or heard them described as) smaller than about 10—11 inches. (See table V). The stock of this fjord, which now presumeably ought to be looked upon as a »nursery« of German Sea plaice, seems then to be very little mixed with early ripe specimens which are so common east of the Skaw.

It cannot be denied then, that there is a *great individual variation* (chiefly in the seas east of the Skaw) with regard to the size (length) with which the plaice attain ripeness for the first time. To be sure, I could not always decide with certainty, whether a plaice had spawned before but just then restored its sexual organs since its last spawning-time, and thus draw a boundary-line which would hold good for all individuals, between immature fishes (which have never spawned) and mature ones (which are just spawning or have spawned before). I have been obliged to content myself with drawing the boundary-line in or near the spawning-season between »ripe«, i. e. actually spawning (or nearly spawning) fishes, and »not ripe«, i. e. spent and immature ones, a boundary which during the spawning-season, in *broad features* and at a certain place, must be very nearly the same as the former, if it is drawn as a straight line, i. e. when it cuts off all the exceptions. (See *Cunningham:* J. M. B. A., vol. II., p. 227—28).

I admit that it would have been of some importance to be able to decide this question: mature or immature, for instance in the Limfjord, table V, column 1 & 2, in order to see whether these large fishes were really immature in the sense that they had never spawned, or whether they only suffered this spawning-season to pass by, a question I am unable to settle here with certainty. I take it for granted, however, that every plaice does not spawn every year, even though it is a mature fish*).

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*) *E. W. L. Holt:* Rep. Brit. Assoc. 1892, p. 765—766, says, that it is *always possible* to see whether a fish (»*marine teleostean*«) is mature or not, as its sexual organs will not again be quite as they were before they developed ripe spawn for the first time. (As to the males nothing is said with certainty). I am inclined, beforehand, to think that *Holt* is right here, but I have not myself carried through the matter practically; perhaps I shall be able to do so by renewed investigations. *Cunningham* and *Fulton*, however, have not been able to do so.

In the following I shall call every fish **mature (grown-up)**, when it must be supposed to have spawned once (or several times), or is just spawning, and **ripe** when it is spawning or at any rate is near spawning; *a fish, therefore, can become ripe several times in its life,* even though it will not become so every year after it has reached the mature stage of life.

I speak distinctly of **grown-up** fishes, not of **full-grown** ones; for most fishes, evidently, continue their growth after they have become ripe (and thereby grown-up) for the first time. A glance at the table (I) will easily show this. Differences between the various races, certainly, have some influence on the size of the mature plaice, but that some specimens of them, 7 inches long, should be *full-grown*, while others are not *ripe* till they are $22^1/_2$ inches, nay, at Ireland even 29 or more (table IX), is most improbable.

What we know, for instance, of the *salmon* is also contrary to the supposition that all fishes must be full-grown when they spawn for the first time.

It seems that plaice, everywhere, *generally* become mature in their third year, some already in their second, but, as a rule, they become so with a smaller size in the Baltic than in the Belts, than in the Cattegat, than in the Limfjord (and German Sea). The same thing has been proved also on the shores of Great Britain, where *Fulton*, *Cunningham*, and *Holt* have stated a corresponding difference in the length with which this fish becomes mature at the various places, so it is not peculiar to our seas. — We might think the reason of this was that plaice become ripe for the first time at a different *age*, some two years old, others three. The age certainly has some influence, but this cannot explain that, in our seas, it is just in towards the Baltic Sea that the small ripe fish are found in the greatest number. No, *individual* difference between the lengths attained by the different individuals at their different ages must be, by far, the most important condition for the understanding of the whole matter, which does not exclude that also difference in age here may play a part. — Perhaps we get nearest the truth by supposing that if the pelagic fry of the plaice in their growing-period come under fortunate conditions (the northern Cattegat), then they will become large, if under less fortunate conditions (the Belts), they will not become so large till they breed for the first time. They may be compared to seed which is sown in good or less good soil; in the former case the plants become large, in the latter small. It is, consequently not necessary that there must be different races to explain the existence, at certain regions, of smaller individuals, whether now these are plaice or plants.

Even though we may point out other peculiarities than difference in size in the plaice from different parts, for instance a somewhat different number of rays in the fins, etc., this does not prove neither that we have to do with *real races, which propagate generation after generation* **with the peculiar stamp of the race;** for we must prove first that these peculiarities have not, like the size, been produced by the natural conditions *for each single individual in the first generation.* It lies pretty near, certainly, to think that it is so with the plaice, also, for instance, with regard to the variation in the number of rays in its fins; for its pelagic eggs and fry are by the currents carried about in nearly all our more open seas so quickly that a close intermixture of the eggs of all plaice must seem to be the unavoidable result. When, in spite of this intermixture of eggs and fry, the plaice after all appears in *one »form«* in the Belts (and the Baltic) and in *another »form«* in the Cattegat properly so called, forms which are not intermixed, then this may be the result of two circumstances: 1) that eggs or fry of one form die when they are carried into the territory of the other; 2) that eggs and fry of one form, when they are carried into the territory of the other *live,* but, *by the natural conditions there, are developed into fish of the »form« which belongs to that place, though their parents are of the other »form«.* — We might suppose, for instance, that eggs and fry of the larger form are unable to live in as brackish water as the fry and eggs of the smaller form, and that they must die, therefore, if they are carried too far up our seas; but it is scarcely probable that eggs and fry belonging to the form that lives in brackish water should die also, when carried into water of greater salinity; for if the eggs can stand the brackish water then they will live so much the better in the salt water, where most eggs of plaice are to be found. The first supposition alone 1) will then scarcely be able to explain the geographical separation of the two forms, and I believe that the second supposition, that one »form« changes into the other already in the first generation, is necessary.

I hope some day to return to this interesting question, and to give further information on it than I am able to give at present. The question is one of the greatest interest, both theoretically and practically, as it touches on the formation of races as this is actually going on in nature, as also on the other question: whether it may be possible to improve on our races of little plaice by the introduction of larger races, which not only grow to a larger size but also grow quicker and consequently give a greater profit of the whole stock of fish.

That one »form« thus in the course of a few generations can change into another »form« is not without known parallels in the animal and vegetable kingdoms, and it is evidently *a very common phenomenon in nature,* though one, I am sorry to say, which has hitherto been but little regarded. — I shall here only remind the reader of certain species of crustacea (*Artemia*) which, when carried from fresh into more saline water, can change from one species to another in the course of *a few* generations, nay, even to another genus, and of certain species of ferns (of the genus *Adiantum*) which, in the course of six generations, when cultivated on a soil containing serpentine, will change into other species, which not only in form but also in various biological relations (green or not green in winter) are different from the former. —

Résumé: It is not possible then, even within a certain sea, to indicate *a certain length* which distinguishes *all* grown-up and mature plaice from *all* not grown-up and immature; for all plaice do no become grown-up at the same length, even irrespective of the difference which is owing to the sex; but it is possible to indicate an *approximate length* which in broad features distinguishes the mature fish from the immature (**the fry**).

This length is different in the different seas: the Limfjord together with the German Sea, the northern and southern parts of the Cattegat, the Belts and the Baltic east of the isles of Sealand and Falster.

Having shown in the above section that the **mature** plaice have a different size in our seas, I shall here give some particulars with respect to the occurrence of *the immature fish,* **the fry,** and show that the latter also in open nature are arranged in groups according to their size. I shall show *how many* of these groups we may count, a matter which will elucidate various things respecting the growth of the plaice, and especially give information as to the question of *how many years it requires before it becomes mature.*

In order to find out whether a number of such groups arranged according to size (»annual series«) may be proved to exist of plaice in a given sea at a given time, as it has been proved with respect to other flat-fishes, *the northern Cattegat* (at the Skaw, Aalbæk, Jerup, Frederikshavn, Bangsbo, Sæby, Læsø Rende, off the Mariager Fjord) was particularly explored, several times in 1891, table VI, column 1—2, in 1892, table VI, column 3—17, in 1893, table III & IV. In 1891—92 the explorations were carried on by myself onboard the »Hauch« or »Havørnen«, in 1893, on the other hand, by Mr. E. Bay, or Lieutenant C. J. Hansen, R. N. (See the tables). The fish in these tables are caught just in order to get information of *all* sizes of plaice (also the small) which may be pointed out in these seas. On that account *prawn-catchers* of *bobinet*, *plaice-seines* with *small meshes*, and *Ammodytes-seines* (of a peculiar coarse sort of linen from the Skaw) have been used in catching them. A few times we have tried to supplement the researches by the purchase of larger fish from the fishermen, who as a rule do not catch the small individuals. (See for instance table VI, column 3). What sort of fishing-tackle we used is generally indicated in the tables. — For further information as to the character of the fishing-tackle, I shall mention that *prawn-catchers* are used while *wading* on the shores, and are fit for catching very small young flat-fishes; the larger ones generally are swimming too quickly. This is clearly seen in table III, column 3. — *Ammodytes-seines* can catch both small and large fish, but not so great numbers of the latter as *the plaice-seine with small meshes,* which, as the water more easily passes through its meshes, is capable of being moved more quickly along the bottom; on the other hand the *plaice-seine* cannot catch the very small flat-fishes (under c. 2 inches in length) except quite exceptionally. *Ammodytes-seines* and *plaice-seines with small meshes* can both be used, partly from land to be drawn towards the sea-shore, partly as »Snurrevaad« from a vessel lying at anchor on the sea on any depth. — By combining the use of these three sorts of fishing-gear we have succeeded in getting good information of all the present sizes of plaice (and other flat-fishes), as shown in the tables, both in the *Cattegat* 1891—93 as also, with the assistance of Lieutenant *Hansen,* in *the Baltic Sea properly so called* in 1893, table VII—VIII. Further there is information of the size of the plaice from the places where the Biological Station has been anchored up during these years, viz. the *Lesser Belt* and the *Great Belt,* table II, and moreover much information of a more varied kind in the section »Researches No. 1—238«, which has not been included in the tables. Further, in table V, column 3—9, I can give information of the plaice which are caught in the Limfjord by the fishermen with various sorts of fishing-gear, with small as well as with large meshes — information which I ove to Mr. *Tranum.* Finally, in table V, column 10, is shown the contents of plaice in one draught with an *Ammodytes-seine, as this fishery is carried on at the Skaw.* We have then here really considerable materials (many thousand fish), which cannot be denied a certain demonstrative power, even though we must be very careful, as always when we have to do with fishery, especially when we are obliged to draw our conclusions, as the case is here now and then, not only from positive observations but also, as it were, from negative, i. e. the want of certain sizes of fish in various seas at various times.

Besides information of the actual sizes of the plaice we caught, set down for each specimen by means of a • or , on a scale of Danish inches, the tables contain something which is *theoretical*, viz. the figures 0, 1, 2, 3. By these I have intended to indicate that the *group* of fishes, beside which they are printed, is not quite one year old (0), between 1 and 2 years old (1), between 2 and 3 years (2), three years *and more* (3). (Later on, further particulars on this matter).

The group which, at any rate at certain times (May, June, July etc.), is most sharply distinguished from the other groups with regard to the size (length) of its individuals is the 0-group (see the tables). It occurs in the tables from the month of May as quite small specimens, about 1 inch long, and has been followed till November, table VI, column 20 (the Skaw) where by means of a plaice-seine with small meshes it was proved in 1892 to comprise specimens from $2^{1}/_{2}$—4 inches. There have probably been still smaller specimens at that time at the Skaw; for in 1893 when Lieutenant ***Hansen*** particularly pursued these young fishes (0) at Bangsbo with *prawn-catcher* and Ammodytes-seine from May—October, the smallest ones (table III) were even but $1^{3}/_{4}$ inch long on the 19. October. How now this may be, whether perhaps there is a difference between the various years, so that the fry now grows a little quicker now a little more slowly, I shall not stop to consider (cmp. however table II, Fænø, 29. Septbr. 1891); we shall scarcely meet great differences here.

This 0-group is found numerously represented in the *northern Cattegat* (the Skaw, Aalbæk, Frederikshavn, Bangsbo, at Hals, by the Limfjord and Mariagerfjord); moreover I can state that it is found on the *northern shore of Sealand* (this is not in the tables but in the »Researches No. 1—238«); it was found in the *Lesser Belt* 1891 (table II), but not in 1892 & 93, furthermore it was found at *Kjerteminde* and in *the northmost part of the Sound* at Snekkersten, but *south of these places I have found only 4 specimens* **in all**, which *perhaps* may be classed among this group, 3 of them at *Bornholm* (Snogebæk), table VIII, one at *Hesnæs on Falster,* »Research No. 113«, 2 inches long.

This result, that these small specimens of plaice are caught in almost unbounded numbers in the northern parts of the Cattegat, always immediately on the shore, but are so to speak quite wanting in the seas south of

Funen, Sealand, and as much of the Baltic as we have hitherto explored, is an incontestable fact.

Whether these circumstances are the same every year, of course I cannot tell; there may be some variation, I dare say; this is indicated by the occurrence of the fry at Fænø 1891 and its disappearance in 1892 and 93, and I have moreover been informed by *Dr. Apstein*, at Kiel, that he has been unable to find such fry this year at Eckernførde-Fjord, while they had specimens from former years, partly from Kiel, partly from Neustadt. Professor *V. Hensen* had been kind enough on my request to ask Dr. *Apstein* to examine this question*).

Although we must thus suppose that the distribution of the 0-group is not quite the same every year, I cannot doubt it will prove to be *the rule, that such small plaice* (under c. 2—3 inches) *are not found in great numbers (except perhaps at a few places) on the shores of the Baltic, and that the numerous stock of plaice here* (for instance at the isle of Møen, see table VIII) *must consequently be born somewhere else and afterwards immigrate into the Baltic Sea.*

I say that the stock of larger plaice is numerous in the Baltic, and shall for the further elucidation of this matter refer to »Rersearch No. 110«, during which in one draught with plaice-seine off the isle of Møen were caught 594 plaice, besides 487 Pleur. limanda and a few other fish, in all 1087 specimens of fish in this one draught.

When we hear, moreover, that the fry of other flat-fishes (*Pleur. flesus, Rhombus maximus & lævis*) which in the Cattegat lives together with the fry of plaice on the shores, during these researches was found also in numbers on the Danish shores of the Baltic, and that it was only the fry of the plaice which was wanting here, this must be looked upon as a further proof of the correctness of the statement. (How to distinguish the fry of the various species will be mentioned afterwards).

At another place I have shown that certain animals which in the Cattegat are littoral occur in the Baltic on deep water, though certainly also as littoral forms, for instance *Cardium edule.*

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*) Mr. *G. Duncker* has afterwards kindly informed me that he found, in 1893, the tender fry of plaice smaller than 2 inches »in numbers« in the cove of Neustadt off Lübeck, so that there can be no doubt that some of the great numbers of eggs which in spring are found in the Baltic may be developed there, at any rate in certain years. Till further researches into this matter I must suppose however, on account of the almost total want of fry on the Danish shores of the Baltic, that this does not take place so generally that we can believe the Baltic to have a stock of plaice of its own, which really breeds there in numbers and as a rule.

I imagined therefore the certainly rather far-fetched possibility, that the fry of the plaice perhaps might live on deep water in the Baltic, though it is particularly littoral in the Cattegat, and with the assistance of the »Hauch« I explored the deep with Ammodytes-seines in order to see whether it was living there. It was not; but during these explorations quite small specimens of *Pleur. limanda* were found on deep water, to be sure only a few (14) specimens, yet enough to confirm my supposition in »Report from the Biol. Station III, 1882«, p. 16, that it must be so. — Cmp. »Research No. 159« *).

Having thus mentioned the geographical distribution of the 0-group east of the Skaw, we pass over to the next question, viz. its *age*.

This question is closely connected with that of the *spawning-season* of the plaice and the *duration* of this season, about which I shall say that it extends over a very long time of the year, from November—April, both months included, consequently over about half the year.

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*) *Note.* It cannot here be left unmentioned that *G. Winther* in »Bidrag til Kundskaben om Fiskeriet ved Torbæk, p. 314. Nordisk Tidsskrift for Fiskeri. Ny Række. 1. Aargang. 1874«, speaks of the occurrence of the plaice in our seas, and among other things says that its fry is found in the Sound, and that it, »scarcely half an inch long, is found in the month of June everywhere«, etc. He does not tell how it can be distinguished from the fry of *Pleur. flesus* which is living there, loc. cit. p. 315, so it is not impossible that he has mistaken one species for the other; »scarcely half an inch« is too short for a great number of plaice in the month of June. His statements as to the age of the plaice are not supported by reasons, and whether right or wrong, therefore, they are useless in a scientific discussion. The same applies to some of his other remarks respecting the biology of the plaice; many of them, evidently, are founded only on loose statements of fishermen, and are certainly quite wrong, though they often may be proved to originate in some (often misunderstood) reality. — In »*Möbius* und *Heincke:* Die Fische der Ostsee. Aus IV. Bericht der Commission zur wissensch. Unters. Kiel« is, under the plaice, a picture of a young flounder in its pelagic stage, which to judge from its form, must surely be a young *Rhombus*; this is made more likely still by the statement »So trifft man sie namentlich im Mai und Anfang Juni bei ruhigem Wetter an der Oberfläche an«; for 1) this time agrees very well with the time for pelagic fry of *Rhombus*; 2) it agrees but badly with the time for the pelagic fry of the plaice; 3) I never saw the latter swimming about in the surface of the water, though perhaps they may do so at times.

How these young ones according to the statements of the above authors can be seen in an aquarium developing themselves into flounders *turned to the right*, is a riddle to me. Probably there is some mistake of identity; till this is cleared up I cannot help doubting the correctness of these gentlemen's statements with respect to the fry of the plaice in the Baltic Sea. That, on the other hand, the fertilized eggs of the plaice are to be found there is well known from *Hensen's* excellent researches.

If we would look for information about the fry of the plaice in the older literature, we should probably find various observations on this question; but I doubt whether it would be worth our while to do so, and leave it to others who have more leisure time than I have, taking into consideration only the later piscatory literature on this subject. This is already rather extensive, even when we do not count all that which treats the matter in an unscientific way and only gives statements unproved by any precise and positive facts.

On the 21. November 1893 great numbers of eggs of plaice with large embryos were found floating in the water at Fænø, and the number of eggs is constantly increasing. (This is written in January 1894).

In April 1892 eggs of plaice were still found at Fænø, but in decreasing numbers.

Everyone who knows pelagic eggs of fishes in our seas, will know that the eggs of plaice are easily identified on account of their considerable size (up to 2^{mm}) and other peculiar qualities, especially in the embryo, and I find therefore this a more reliable way of determining the duration of the spawning-season of this species of fish than a study of the ripe fish, which are far more diffcult to meet with in great numbers. (Cmp. *Hensen's* calculations on the *number of plaice* in the Baltic Sea). It is a matter of course that the two methods supplement one another and *in casu* agree very well, and I have got the impression that it is particulary in the months of December—March that most plaice are spawning. — If then we will state approximately the birth-time for the great mass of plaice, it may be said to fall in the heart of the winter, and I have looked upon all the little plaice of the 0-group as just passing into their completed first year in the month of March. They are therefore in the tables marked I, while they are marked 0 through the whole preceding autumn.

With the information that the spawning-season of the plaice lasts from November—April, with a maximum in the heart of the winter, we shall now return to the 0-group, which we found on the shores of the Cattegat in the month of May and folloved till November in the same year.

It is astonishing that we do not find the young fry on the shores till May, as some eggs at any rate are shed in November; for the hatching of the eggs, in many cases, does not last long, judging from my examinations of eggs which I have caught; but probably the duration is dependent, to some degree, on the temperature.

J. H. Fullarton: Ninth Ann. Rep. Fish Board. Scotland, p. 311. 1890, states that they are hatched after 16—18 days at 6° C. — The yolk-sac was subsequently absorbed in the course of 12 days.

While the larval fish have their yolk-sac, they are according to my investigations c. $6—7^{mm}$ long, and when the yolk is absorbed and they have grown somewhat unsymmetrical and compressed, with their left eye sitting nearly on the edge of the brow, but while they are still transparent and *pelagic* fish, they are c. 10—12^{mm} long. With a length of 12^{mm} many have already attained the flat-fish form (white on one, coloured on the other side; the position of the eye settled) and live on the sand near the shores. It seems as if there is already here some difference in the growth of the various individuals, so that they are not exactly of the same length when the development from a pelagic fish to a bottom-fish is going on, but it may take place at c. 10 and at 12 $(13)^{mm}$.

At the pelagic stage, after the yolk has been absorbed, it cannot be kept alive in aquariums; at this stage the larvæ must be caught in open nature, and this is not always easy. Though I have searched eagerly I have been unable to find them in greater numbers (only 10—20); when they afterwards live on the sand they are common enough. — This pelagic stage, while the eye is changing place, is the least known period in the life of the plaice; already at this stage almost all the rays in the dorsal, anal, and caudal fins are being developed, so that they are easily distinguished from *Pleur. flesus* by means of the number of rays. (More about this later on).

The plaice then is born from the egg c. 6—7^{mm} long, and is found on the sand already when c. 12^{mm}. Is it possible, indeed, that the larval fish of the first laid eggs in November, which must, consequently, be supposed to be hatched early in December, not till the month of May next year have been developed and have grown c. 6^{mm}? that, consequently, some require half a year to grow from 6 to 12^{mm} and pass through their development?

When they are not to be found on the sand-banks before that time, and it has not been possible for me to find them there though I have searched for them diligently, we must almost think so, if they have not somehow understood to hide away on deeper water where, certainly, I have been fishing but very little in early spring with fishing-gear that can catch such little fish: but as the development from pelagic to non pelagic plaice is going on also at a later time in April and May (June) of the eggs which have been shed in March and April they must certainly have been observed at that time, if on the whole they were to be found on the deep.

They are found on the shores, that is a fact, and they are never found on the deep (2—3—4—10 fathoms); even the succeeding sizes (up to 1—$1^1/_2$ inch) are found on quite shallow water only, so I cannot help believing *that the little plaice never live on the bottom on deeper water:* nor have I ever in literature seen stated that they do so; all statements agree on this point, that they live immediately on the shore.

It is therefore a remarkably long time the fish, which are born in

November, must use for their development, viz. half a year*); for we can scarcely imagine that all these *early* eggs are destroyed if they are not carried outside the Skaw to seas where perhaps the development can take place without being hindered by temperature or ice as in our shallow waters, for instance to the western shores of Jutland or such places where there is very little ice**). When we see that the eggs which are floating in the Baltic Sea and have been fertilized there, and which *Hensen* as we know has often found in great numbers, are scarcely hatched there, except *perhaps* quite exceptionally, then we cannot help fancying this second possibility.

It has long been supposed that most eggs of plaice which flow fertilized about in the water, must be destroyed; but it has been supposed also, perhaps, that most of them were destroyed by other animals, which eat them. It is my conviction, however, that the physical conditions here play an exceedingly important part, and this is particularly conspicuous if we try to imagine how all the larval fish which have come out of the eggs are to reach the shore; for, they must either be able to hasten on their development from pelagic animals to animals that live on the bottom when carried to the shore by a fortunate current, or they must sink to the bottom when it is required by their development. Those which sink down too far from the shore must be destroyed, for no small plaice are found on the deep. Those only which sink to the bottom near the shores will be kept alive, and when we remember the area of the bottom, the volume of the waters, and the distribution of the eggs, we see that they, certainly, form but a very small fraction of the whole number of larval fish.

That these little, c. 10^{mm} long, animals, should actually immigrate to the shores is here looked upon as unimaginable.

In the winter-months I have repeatedly looked for the little plaice (the 0-group) at places where they were found in autumn but always with

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*) Comp. *Schiødte's* evidently false supposition concerning this matter.

**) Among the flat-fishes I have examined, and whose fry I have proved to live in our seas, it is only the *plaice* that requires such a long time to pass through its pelagic stage, or rather, it is only the plaice that requires such a long time between the beginning of the breeding-season and the first appearance of the fry on our shores; for the spawning-season of *Pleur. flesus* is much later (the early spring-months), and yet its fry appears on the shores scarcely a month later than that of the plaice.

The fry of *Rhombus lævis & maximus* and of *Solea vulgaris*, whose spawning-time is still later, on the borders of spring and summer (May—July), appears already on our shores in the months of July and August.

Of *Pleur. limanda* I know too little as yet to be able to give the precise data, but it seems also to follow the rule, that the nearer the warm season the spawning-season falls, the shorter time passes before the tender fry is seen on the shores.

the result that I found none or only very few*); whether they bore down into the sand so that the seine cannot fish them, or whether they go out on deeper water where I have had no opportunity of fishing in winter-time, I cannot tell. The fishermen believe that they go down into the sand, and I should feel most inclined to think so too. We must then content ourselves with looking for them in spring, but they do not then any more belong to the 0-group, but to the 1-group, for they are now on an average more than one year of age.

We left them in the autumn 1892 as fish of 2—4 inches (table VI, column 19, 20), and find them again in the northern Cattegat at Bangsbo in May 1893, as fish of 2—4 inches in length, under which the new 0-group is clearly to be seen (table III, column 1, etc.). In the course of the summer, however, they disappear from the sea-shore (see table III), and give room for the 0-group; for they are becoming rarer the later in the year they are examined. *Winther*, loc. cit., p. 314, seems to have seen something like this in the Sound. There is then an emigration of these fish from the shore, and it has commenced, perhaps, already in the winter. In order to follow this emigration an investigation of the seas at Aalbæk was undertaken in July 1893, table IV. It will be seen in the columns 2—3—4—5—6, distributed according to the depths, that the plaice are larger the farther we are going out, and if we make a summary of these five columns (column 1), there is besides the 0-group a 1-group from $2^1/_2$—2 inches, and a 2-group (or part of one) from $6^1/_4$—10 inches. I am sorry to say that the investigations were not carried on farther off on still deeper water; these two *amalgamated groups* would then perhaps have been better represented, i. e. the larger specimens belonging to the 2-group would then perhaps also have been there.

I have once before, 1892, attempted such an investigation with a series of draughts from shallow to deeper water, table VI, column 3—8, suffering the 2-group to be represented by fish caught by the fishermen in plaice-seine with large meshes, column 3 in the table. Owing to great haste these fish were badly measured (see the table), but the summary-column 8 shows clearly a 2-group which is pretty clearly distinguishable from the 1-group. Here now is the remarkable circumstance that, though the investigations this year, 1892, were carried on earlier in the year (March) than in 1893 (July), the specimens of both groups are evidently larger, and the point at which the two groups meet is one inch above that of 1893, viz. at about $7^1/_4$ inches against $6^1/_4$ in 1893. This may to some degree be owing to the different way in which the investigations have been carried on, perhaps also to a slower growth of the fish in 1893 on account of the particularly severe ice-winter — or perhaps to quite other circumstances. — My more immediate aim, however, is here only to prove that such groups of fish of the same size are actually found in the sea; not till systematical investigations are untertaken at the same places through a longer series of years will it be possible more closely to discuss that sort of questions. —

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*) This year (in the winter 94) I have succeeded however in finding these little fishes at Snekkersten and Kjerteminde. This winter is uncommonly mild.

In table V will be seen a number of fish from the *Limfjord*, caught by fishermen in the days of 12th—19th July 93, at about the same time, consequently, as those in table IV; they are caught with eel-handseines, a fishing-gear which catches the little plaice almost as well as my plaice-seine with small meshes, and the large ones too. — Column 6 in table V shows the result of 8 such draughts with a distinct 1-group and a distinct 2-group, and the point where they meet is c. $^3/_4$ inch higher than in table IV, probably because the »race« of the plaice is larger in the Limfjord than in the Cattegat. In spring 1893 I marked 1000 specimens of this 2-group in the Limfjord, 7—10 inches long, and so proved their quick growth; they were 13—14 inches long in October—November this autumn: see the double column 9 table V (also column 3 & 4*). Consequently there are also in the Limfjord a 1-group and a 2-group which are almost identical with these groups in the Cattegat.

The English investigators *M'Intosh, Fulton,* and *Cunningham* have often pointed out that the fish do not grow equally quick, and that we cannot, therefore, say in all cases how old this or that specimen is. I here quite agree with them; it is proved by the near connection between the groups. But it is another question whether this will be of any great moment with respect to the *average* growth of the fish. Even if every fish was marked with its age, we would not content ourselves with this, but *as they do not grow equally quickly,* we would try to find out *how great the average growth is,* and it seems to me that I have *just done so in pointing out the various groups* 0—1—2 etc.; for each of these is pretty nearly

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*) Note: *Perhaps* there is no 0-group in the Limfjord. I have not been fishing there myself, but the fishermen assert, that the little fish immigrate in great numbers from the German Sea, and I am inclined to think that they are right. Ripe fish seem also to be missing in the fjord, or are found but very exceptionally. Nor are there any eggs to be found, to judge from one single investigation which was undertaken by Mr. *Teilmann-Friis* at a time when the Lesser Belt was teeming with eggs of plaice.

an annual series and shows exactly how much the plaice (i. e. the whole stock) grows *on an average* every year.

Another question is, whether I have always in every single case succeeded in distinguishing between these annual series; I hope in future to be able to examine this closer. The *method*, I hope and believe, will lead us to the goal at length. —

It appears to me that the groups 0—1—2 etc. of the plaice must be pretty well separated in nature, when we can point them out by merely fishing promiscuously and making a summary of the results of these draughts. For besides distinguishing between the sexes we ought also properly, when we want such a summary, to fish the same number of specimens of each annual series, in order not to efface the boundary lines between them.

This is of particular importance where the various sizes within the annual series, as the case is with the plaice, are found on different depths, and it is clear that if we would fish but little on shallow and on deep water, but very much on the intermediate depths, we could efface all difference between the series, in many cases on account of the too great influence of exceptions. I have therefore generally tried to avoid a too great crowding at one place in the row, *and practice has shown that it is easy to avoid it.*

Among other fishes, for instance the eel-pout, where all annual series may be fished in the same draught, this difficulty does not exist at all.

We have thus followed the plaice through its first year (the 0-group), into the second (the 1-group), nay, into the third (the 2-group), and have seen it withdraw more and more from the shores.

While the 0-group, so to speak, was completely missing in the Baltic, there being scarcely any specimens under 3 inches (there were 4 exceptions) (see table VII & VIII), the 1-group and 2-group are richly represented (see table VII & VIII). Column 10, table VII, is a summary showing both groups; the point where they meet is perhaps a little lower than in the Cattegat, viz. a little under 6 inches against a little over 6 inches in the Cattegat. —

The 1-group is, with very few exceptions, not represented at Bornholm (table VIII), from which we can draw the conclusion that the plaice does not go there till it is more than two years old. The many seine-draughts indicate this very decidedly, and if we study closely the localities in table VII, it will be seen that the farther we go west of Møens Klint the more numerously is the 1-group represented, so that Lieutenant *Hansen*, who undertook these measurements, arrived at the conviction that the plaice immigrate into the Baltic through the Great Belt south of Gjedser, a result which also to me seems very likely. —

I had thought *by the help of the »Hauch«* (steam-windlass and long lines) to be able to fish *with my own plaice-seines* so many large plaice in our seas that, as the case was with *Pleur. flesus* (Report of Biol. Stat. III. 1892, table II), I could point out the boundary line between the 2-group and the 3-group (the 3-group comprises *all* plaice more than 3 years old); but my hope was not fulfilled after all: *I have nowhere by my own explorations found any 3-group numerously represented in the northern Cattegat* where the fry in all sizes is most abundant.

In *the Baltic* on the other hand, where a great number of the plaice are caught, the largest specimens (table VII, column 10) most likely represent a 3-group; for if they are compared with the ripe and grown-up fish at the same place, table I, column 11—12—13 (Stevns & Rytzebæk) then we see that their size is the same, so that I must suppose that 8—9 inches represents the point where the 2-group of the plaice comes up with the 3-group, as it must necessarily do at some time, as the 3-group does not grow as fast as the 2-group*).

When it is so difficult to me to find representatives of this 3-group of the plaice, especially in the Cattegat, more so than it is with *Pleur. limanda & flesus*, the reason is, as far as I can see, that it **has been fished up, to a certain degree,** so that specimens of it are rare compared to those of the 2-group. Be it remembered that this fish in later years has been pursued exceedingly much, and particularly so in the Cattegat where the question was to be solved, so that the fishermen told me, when I paid a visit onboard while the fish, table VI, column 3, were measured, »that if they only knew a place in the Cattegat where they could fish better, they would go there immediately; but they did not know where to find it« — nor could I tell them. They fished there chiefly two years old fish, more than half the number of which were under the size limit, and only few were three years old. I must suppose that scarcely one fourth of these fish have ever spawned, three fourths then were immature (not grown-up) fish. There were many fishermen day after day fishing this particular size of fish, *because they knew no place in the Cattegat where the fishing would pay better.*

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*) Note: The larger the race of plaice is which we examine, and the longer the single specimen accordingly will be before the quickness of its growth begins to slacken by commencing maturity, the higher up on the scale must the point be where the 2- and 3-group meet, and the situation of the point will, I dare say, always be near the point at which most specimens become ripe for the first time. There are in the tables indications of a higher position of these points, the farther we get out towards the German Sea, but, partly, this has been explained already in an earlier section, partly, the present materials are not sufficient for a closer examination of this matter.

In order to show the size of the plaice elsewhere, where there has not been fished too much, I shall refer to table IX from *Iceland.*

The fish here have been caught with place-seines, such as are used by the fishermen in the Cattegat. The fish are measured by Mr. *Lundbeck,* on a trip in a Danish fishing-cutter along the shores of Iceland, where they are going now just because the fishing has become so poor in the Cattegat. Compared to our largest plaice (table I, column 3—6) the Icelandic are indeed giants, most of them being about 16—18 inches, and the largest ones about 29 inches. If fishing-gear with which all sizes could be taken had been employed at Iceland, I suppose we should have got a good survey of the groups; now we see only a fully developed 3-group, table IX, column 1; it would correspond very well in size to the supposed 3-group which we miss in the Limfjord, table V, column 3 & 4, and which must be supposed to emigrate to the German Sea.

The plaice of the *German Sea* are a large race, probably about the size of the Icelandic. *W. Fulton* states for instance that the plaice on the shores of Scotland become as long as 28 English inches, and that they do not become ripe, in the earliest cases, till they are 12 Eng. inches long. The plaice of the Baltic and a few from the Cattegat are ripe already when they are 7 inches.

In the Cattegat, however, the larger and the smaller races are surely mixed together, and they cannot well be distinguished from one another there, save by a mere estimate of the tables.

Though it must, consequently, be sonsidered probable that the Icelandic plaice in table IX represent a race which, *on an average,* is somewhat larger than that to which the Cattegat-plaice generally may be said to belong, yet there is no doubt *that the latter are very small, and that they have scarcely been so small always as they are at present.* I am sorry I cannot here give the measures. To do so I must have commenced the researches about 10 years ago; but I do not think that any capable man who personally has had to do with fishery during these years, will deny the fact, that the plaice in the Cattegat has decreased in size in these later years, if he will speak according to his conviction. I shall return to this matter later on.

Of course it is not my opinion that no large plaice is to be found in the Cattegat now; such are constantly caught as yet when the fishermen go out on the deep parts of the eastern Cattegat where, from various reasons, the plaice has been left more in peace; what I want to say is, that it is now necessary to search much more for such large fish than it was a few years ago, and that they are now scarcely to be found at several, nay at *most* fishing-places, where they formerly were common.

The Danish fishermen have a peculiar name for the large, often lean and not very palatable plaice: »Hanser«, the *Pl. borealis* of the older authors (*Gottsche, Faber*), at a few places called »Præsteflyndere« (i. e. »priest-flounders«); these have evidently become rarer in the Cattegat of late years, owing to their being fished up. But also those plaice which are the next of size, and which afforded a valuable commodity, fish of about 20—30 lbs. the score (corresponding to a length of 12—18 inches), have become rarer, and the well-known »Frederikshavns-plaice«, which were so renowned for their size and taste, are now almost a thing of the past.

To catch plaice of 18—24 lbs. the score, we must now in under the Swedish coast (or out of the Cattegat) where our fishermen did not know how to fish ten years ago on account of the deep water. On the old fishing-places they mostly get plaice weighing 9—15 lbs. a score (corresponding to lengths of 10 ($9^3/_4$)—13 inches). —

Probably it was on account of this decrease in the size of the plaice that the fishing-trade in the Cattegat in 1884 gave up using the *score* as a standard and chose the *pound* in its place; and just because the plaice was not weighed in former times, it is now impossible to get information in *exact* figures of its average size about 15 years ago. I have been able to get only statements as the following: A fisherman who owns two fishing-boats with tank tells that one of them »in former times« could hold 70 scores of plaice, but now (though it has not been made larger) it can hold 300 scores, so small have they become. —

I *cannot*, consequently, give any real statistics to prove the decrease in the size of the the plaice — but, I am sorry to say, they will scarcely be missed.

As above stated, I have not succeeded in fishing the 3-group of the plaice in **the Cattegat** *with my own fishing-gear* in so many specimens that it has been able to assert itself in the tables before the largest specimens of the 2-group, and I must therefore content myself with referring to table I, which contains the fishermen's draughts of the 3-group; but as the fishermen do not catch the small fish also, and as, further, the specimens in the tables, as a rule, are assorted, the table does not show this group in its proportion to the 2-group. —

The 3-group seems also to be rather scarce in the **Baltic**, compared to the smaller groups (table VII & VIII) which, as the fishermen do not fish much for plaice here (i. e. east of Sealand and Falster), perhaps may be indicative of the emigration of the larger fish from these seas.

In the **Great Belt** at Kjerteminde (and in the **Lesser Belt**) (see table II) a 3-group of ripe fish, however, does not seem to be rare, and at any rate at the first place (Kjerteminde) it is far more abundantly represented than the 2-group, which seems to be almost quite missing here; for table II, column 9, gives, according to my experiences, a good picture of the numerical relations within the two groups, as they are in the Belt. Are these ripe plaice really to represent the majority of ripe fish *emigrating* from the Baltic? fish, then, which should have *immigrated* to the Baltic Sea from the Cattegat and the Belts when they were young?

Their size might very well agree with this, and nothing that I know of plaice-fishing in the Belts speaks against it — on the contrary. The sudden appearance of the plaice in these seas and their sudden disappearance, phenomena which yearly return, agrees very well with such a migration. — This matter must be further elucidated by future investigations.

It is originally Professor *V. Hensen* at Kiel to whom I am indebted for the thought of such an emigration from the Baltic Sea. *G. Winther* at his time has set forth a *somewhat* resembling supposition with regard to the herring in the Sound.

When the 3-group in the seas around the isle of Funen seems to maintain itself better, it is easily explained by the natural condition of the seas (stones, zostera, etc.) which makes it more difficult here than in the Cattegat to fish up with plaice-seines; partly will these plaice, on account of their smaller size, not repay greater exertions and expenses; finally, they have at any rate as yet been left somewhat more in peace in these enclosed waters than in the Cattegat, so that great numbers of them get *time to be more than three years old. They do not get time,* at any rate not sufficient time, *in the Cattegat* as far as we can see, to reach this age. —

Résumé: We are able to point out in open nature such groups of plaice of various sizes, that the fish must be supposed generally to require three years to become ripe. — The size at which it becomes ripe the first time is subject to considerable individual variation, irrespective of the influence of the sex, and we can only point out an *approximate average size* with which maturity is reached; this size is different in the different seas, small in the Baltic, larger in the Cattegat. At certain places in the seas (for instance the Aalbæk cove) the plaice is always small;

for the various annual series of the fry live generally separated from the older individuals, near land, preferring, particularly, certain shallow coves and seas; but the young fish emigrate to deeper waters as they grow older.

The first annual series of plaice (specimens under 2—3 inches) is (with few exceptions) missing in the Baltic, and is most numerously represented in the northern parts of the Cattegat. The youngest individuals are also missing in most of the fjords (the cause of this I shall return to afterwards). The fertilized eggs of the plaice, on the other hand, are sometimes found in great numbers in the western part of the Baltic Sea. (***Hensen****). —

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*) Note: *Cunningham*, especially, has lately studied the growth of sea fish (See *Journ. Marine Biol. Assoc. Plymouth*), but he tries to solve the question in a somewhat different way than I have done here; besides founding his opinion on the growth of the fish in captivity (a very dangerous thing) he calculates the age of the fish which are caught in open nature by estimate, by means of the size only. He writes (loc. cit. N. S. vol. II, p. 96): »But it is difficult in this way to ascertain the maximum growth for one year, since a number of specimens of one species often form a continuous series in size, and it becomes difficult or impossible to say where those of one year old end and those of two years begin«; — and loc. cit. p. 97: »It is not difficult to recognise with certainty young fish only a few weeks or months old; but the individuals of a given species brought up in numbers at a single haul of the great beam-trawl form usually a regular series of sizes, so that it is difficult if not impossible to separate definitely those which are one year old from those which are two, and those which are two years from those which are three«. —

I must grant him, of course, that the extremities of the annual series, especially 2 and 3, are very much alike, and that it is therefore impossible with respect to many individuals to say how old they are, and, indeed, I can hardly understand how he has been able by a mere estimate to get so near the truth as he appears to have done in many cases. He has conjectured, for instance, that the plaice can commence spawning in its second year, but that it does not generally do so till it has filled its third; I should hardly have been able to form this conjecture if I had not seen the *size-groups* in open nature, not only those of the plaice but also those of *Pleur. flesus; at any rate we must take these into consideration* when we discuss this question, as it is one of the very greatest importance to all fishery-legislation — where everything depends on knowing, not the growth and age of the single individual, but the *average growth* and *average age* of the fish. With regard to the plaice Cunningham's uncertainty is particularly conspicuous pp. 347—350 in »Journ. Marine Biol. Assoc. Plymouth. (N. S.) vol. II. 1891—92« when he settles the age of plaice of c. 8—12 inches in spring and early summer. He looks upon these as but little more than one year old, but admits that it is possible they are more than two years of age. P. 350 he says of some plaice of $8^1/_2$—$12^1/_2$ inches, which on the 16. May were caught off Esbjerg: »I have accordingly estimated the age of the specimens of May 16th from the Denmark coast at twelve to sixteen months; a conclusion supported by the fact that they were all immature. But some of these specimens may be in their third year«. Yes, I think they are all in their third year, i. e. over two years old and belonging to the 2-group; but this question can be finally settled only by a new examination

I have already now and then touched on circumstances which are connected with the *propagation of the plaice*; it has been mentioned, for instance, that there is a *noticeable difference between the average size of male and female fish,* the former being a little smaller; nor do they ever reach the maximum length of the females. This, however, was not sufficient completely to efface the differences between the annual series in the tables, even if both sexes were measured together, but it may to some degree have prevented the *groups* from standing out so clearly as they would have done if the sexes had been separated. —

Also the *breeding-time of the plaice* has been mentioned already, and it has been shown by means of the occurrence of the easily recognizable pelagic eggs in Fænø sound (in the years 1891—94) that the breeding-time

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of all the sizes of the plaice at Esbjerg. — Loc. cit. no plaice is mentioned in Jan.—June smaller than $1^{1}/_{2}$ inch in length, but in January, April, and May some are $1^{1}/_{2}$ inch long, and are explained by *Cunningham* as the *fry of the year* from this winter; they are always found, however, as the smallest specimens of a large group reaching 2—3—4—5 etc. inches in length; he says also, loc. cit. p. 349: »I do not understand why comparatively few of these young plaice were taken in May«. My supposition, that they are the fry from the preceding winter, will explain this. Cmp. table III for instance, but also my remarks p. 16).

Cunningham says further, loc. cit. p. 349: »At the beginning of June another outburst appears«; these individuals may probably be explained as the fry of the year (the 0-group); yet they are not quite newborn, but c. $1^{1}/_{2}$ inches long. *Holt*, who has gathered the materials, has evidently not got the very smallest specimens. —

Now I do not intend with these remarks to maintain that I, in all cases, can decide the age and growth of the plaice; but my method gives a better survey of the whole matter than those which have formerly been employed, and my results can easily be controlled, revised, and supplemented, which is an decided advantage in a scientific method.

Dr. Wemyss-Fulton has in »Report Scot. Fishery Board« given the first contributions to a more rational investigation into the biology of the plaice and other fish, and particularly pointed out the different dwelling-places of the different sizes in a very careful manner. His *results* from the Scotch seas are nearly analogous to mine from our own, but the commingling of large and small races of plaice which we have, seems to have no analogue in the Scotch seas; on the other hand we may find smaller races at the south of England than on the eastern coats of Scotland. — He has to a great extent labelled the fish with labels like, or resembling, those which I formerly used. In this way he has also given contributions to the question of the growth of the fish; the latter, however, on the whole, do not seem to have grown so much by far, as those with the new labels which I have used in the Limfjord. —

In later years has *E. W. L. Holt* made investigations into questions, which are nearly related to this, both in the German Sea and west of Ireland; also Prof. *M'Intosh*, *C. Williamson* a. o. have worked at this question. For further particulars see »Contemporary Work« in »Report of the Fishery Board for Scotland« which every year renders an account of work of this nature and of fishery-literature on the whole.

lasts from November—April, though with a maximum in January—February. It has been mentioned how it is only in certain parts of the Cattegat (especially the deep eastern parts) that the plaice is found in the breeding-time, and that the spawning individuals on the other hand are rare at Aalbæk and the Skaw (the southern side). In our smaller seas the spawning plaice are found both in the Great and the Lesser Belt (particularly in the southern part of the latter); further they are known in the western Baltic Sea from the waters between the isle of Funen, Sleswick, and Holstein. Great numbers of spawning plaice are known also from the Baltic Sea east of the iles of Møen and Sealand (table I). But in our fjords and shallow sounds spawning plaice are rarer; even in the Limfjord they are found only singly, so that we must say that *the plaice spawns in our more open seas only,* such as the eastern parts of the Cattegat, the Belts, and the Baltic Sea (from the Sound I have no positive information). *Winther's* statement *(Tidsskrift for Fiskeri 1874)* that the plaice in May goes in on the seashore *to spawn* is evidently wrong. The plaice goes in on the shores in spring, not however, in order to spawn, but in order to eat.

When spawning plaice in the Cattegat nowadays are so rare at all places but Anholt, east of Læsø, and on the whole the deep eastern Cattegat, this is quite in accordance with the statement that these parts are the last places of refuge for the large plaice, or at any rate places situated near these. (See a chart of the Cattegat. »Hauchs« Togter. Atlas). Already *Krøyer* says in 1843—45 (»Danmarks Fiske«) that the large plaice must be looked for on deep water, so that this evidently always, in the main, has been the normal order. At Sæby the fishermen expressed to me their astonishment at the increasing rarity of spawning plaice (fish filled with spawn) in the neighbourhood of Sæby in later years; formerly they were common enough. It appears to me that it is easy to understand that it is so; for every plaice which reaches a somewhat larger size, i. e. approaches the time when it is grown-up and is going to spawn, is now fished in the neighbourhood of Sæby, so that, even if many fishes *wanted* to stay there in their mature period, they are no longer permitted to do so.

The number of spawning plaice, therefore, has evidently been much diminished in the Cattegat by this eager pursuit, *perhaps* also in the Limfjord*) (scarcely in our other seas), and they are therefore in the Cattegat principally to be found at or near those places only, where the condition of the bottom, the depth, etc. have prevented a too reckless fishing, while, *perhaps,* they have been fished up for the greater part in the Limfjord or, *perhaps,* emigrate to the German Sea when they become ripe.

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*) They use here a great number of fishing-gear (seines) which fish very intensely, more than in our other enclosed seas. —

The latter supposition will coincide with my view on the conditions in our other enclosed fjords and seas, from which the plaice emigrates in winter when ripe.

Only the Cattegat has thus a *real stock of plaice* which can live through years independent of the stock of other seas. —

The spot where spawning plaice are found in the greatest multitudes is evidently the nearest neighbourhood of Anholt. From this island fishing-smacks, loaded with thousands of scores of lean fish which have spawned or are just spawning, are carried every winter to Copenhagen, where in spite of their proportionally considerable size they are sold at only c. 75 Øre (c. 10 d.) the score. They are scarcely eatable, so watery and thin are they.

It is impossible to say how great a loss our fishery suffers in this way, as long as we have no statistics, but it has been the cause of grief to all who have seen these great multitudes of *large* fish, which half a year later would represent large sums, be thrown away in this manner; much the more so as our object must be now to economize the stock in the Cattegat in order to get the greatest yearly profit by it.

Spawning plaice are also fished elsewhere in our seas, for instance south of the isle of Møen; but these fish are rather small, and they are not taken in such large multitudes as at Anholt. They are the poorest fish I ever saw used as human food, and, indeed, as a rule they are also scarcely saleable.

A great number of plaice then do spawn in our seas, and enormous quantities of fertilized eggs drift about there in winter. This winter (1894) I have had them fished in Fænø Sound by means of a tight bag with a diameter of about 2 feet. Sometimes about $^1/_8$ litre of eggs has been taken in less than 24 hours by making the current run through this bag. It is consequently enormous figures with which we must count in order to make out the number of eggs in our seas (see *Hensen's* excellent researches; also: Report III. Dan. biol. Station. 1892), and we might think that there would be no want of eggs anywhere in our seas, as the currents in a few days will be able to carry them over distances which in a very short time can encompass all our shores and islands east of the Skaw.

As mentioned in Report III there is however, among others, one factor which prevents this spreading of the eggs, viz. *their specific gravity.*

Hensen, who first has examined the specific gravity of the eggs of plaice, states it to be $1_{,0136}$ at $17_{,5}^{0}$ C., corresponding to a salinity of 1_{78} $^{0}/_{0}$. (See Bericht d. Comm. wissensch. Unters. Kiel. 1884, p. 304).

All eggs of plaice, however, have not the same specific gravity, and in order to fix the limits within which it can change with eggs in our seas I made a closer investigation into this matter by means of the fertilized and living eggs which had been caught in the Fænø Sound, and which were sent to me here in Copenhagen in a box which was isolated with respect to heat and cold, and contained glasses with salt water in which the eggs were floating.

In a cold room I mixed liquids of different specific gravity by means of distilled water and common salt, and by conveying a number of living, fertilized eggs into these (by means of a glass pipette) I arrived at the following results:

1) *The lowest specific gravity* at which all the eggs could float was $1_{,0152}$ at $9_{,8}^{0}$ C. (glass areometer), corresponding to a salinity of $1_{,85}$ $^{0}/_{0}$. It must be observed, however, that among a great number of eggs there was *one*, apparently living and unhurt, which would not float at this specific gravity.

2) The highest specific gravity, at which all the eggs sank to the bottom (of course I speak here only of living eggs), was $1_{,0120}$ at 10^{0} C., corresponding to a salinity of $1_{,44}$ $^{0}/_{0}$.

3) Already at a specific gravity of $1_{,0140}$ at $9_{,8}^{0}$ C., corresponding to a salinity of $1_{,70}$ $^{0}/_{0}$, a great number, more than half of them perhaps, sank to the bottom.

These figures agree very well with those of *Hensen*, especially when we remember that his eggs, as far as I can see, were taken out of the plaice and *not fertilized.*

There was among the eggs I examined some difference in the degree to which the embryos were developed, but this did not seem to influence the specific gravity. —

Owing to their specific gravity the eggs of plaice then are prevented from being carried by currents into many of our little seas, viz. into those whose salinity is lower than c. $1_{,44}$ $^{0}/_{0}$; likewise they are excluded from the Baltic Sea properly so called (perhaps with a few temporary exceptions. See *Petterson*: Den svenske hydrografiska Expeditionen 1877, p. 116. — Kgl. Sv. Vet. Acad. Handl. vol. 25, no. 1. 1892).

We might think then that the propagation of the plaice, from this reason already, was impossible in water of a lower salinity than $1_{,44}$ $^{0}/_{0}$; but there is a possibility that the eggs can be developed *on the bottom*, though they are ordinarily developed while floating, and *Hensen* has mentioned, loc. cit. pp. 305—306 that this it not quite excluded from real life.

According to *Hensen's* investigations there are in the western part of the Baltic a great number ot eggs of plaice floating in the water, and he shows that, *almost every month* there occurs such a low salinity that the *eggs must sink to the bottom;* and according to his researches they do so at salinities lower than $1_{,78}\ {}^0/_0$.

I have now shown that some eggs can float at salinities as low as $1_{,44}\ {}^0/_0$, but even such are not always to be found in this part of the Baltic. The eggs, consequently, must now and then sink to the bottom in these seas; but whether they are killed by this I cannot tell, though I think it very likely, as they are exposed to many dangers when they touch the bottom; as stated above, however, fry is not found in any great quantities in the Baltic (except perhaps quite exceptionally), at any rate not every year.

It is not known' if perhaps the young fish which have been hatched from the eggs require a still higher salinity for their further development than the eggs; it cannot be decided, therefore, whether it is this stage which the plaice cannot go through in the Baltic — but nobody, I suppose, will doubt that the hydrographical conditions excert a great influence upon these matters. —

It is strange to see the little tender young fish of *Pleur. flesus* in multitudes on the shores of the Baltic Sea as far away as Bornholm, while, so to speak, there is no trace of young plaice. In the salt regions of the Cattegat on sandy beaches they often live mixed together. Is it now the eggs of *Pleur. flesus* or the pelagic young ones that can content themselves with a lower salinity than those of the plaice?

The fry of *Rhombus lævis* and particularly of *Rhombus maximus* are also sometimes met with in multitudes on the shores of the Baltic Sea from which the fry of the plaice is banished. But I am not so astonished at this; for though the eggs of *Rhombus maximus**) and *lævis* are evidently very rare in these parts, the pelagic stage of the fry after all is so different from that of the genus *Pleuronectes* and evidently, according to my experiences in aquariums, on the whole far more hardy, and particularly not afraid of less saline water; in such we often see the pelagic young ones swimming about, while the young plaice at the pelagic stage must always be looked for in the most saline water we have in our seas.

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*) Note: Fertilized eggs of *Rhombus maximus* require according to my researches a salinity of $2\ {}^0/_0$ in order to float, and will therefore only quite exceptionally be able to float in the western part of the Baltic. —

Cunningham: Studies of the Reproduction and Development of Teleostean Fishes occurring in the neighbourhood of Plymouth. Journal of the Marine Biological Association of the United Kingdom. Vol. I (N. S.) 1889—90, pp. 10—54. With 6 plates — gives the specific gravity of the eggs of the following fishes:

The eggs of **Pleuronectes microcephalus** floated easily in water of a specific gravity of 1,026, but sank in 1,023; — the specific gravity of the eggs about 1,024. — Corresponds to a salinity of c. $2{,}9\ {}^0/_0$—$3\ {}^0/_0$.

On the food of the flat-fishes.

As to the *food of the plaice* I shall mention here only that the *grown-up* fishes, as it is well known, principally live on *bivalves*, in our seas particularly *Abra alba, Mactra subtruncata* and *elliptica, Corbula nucleus, Mytilus edulis**) (of which they prefer the little ones), *Solen pellucidus, Macoma baltica,* etc., but that they eat also other animals, for instance the young ones of *Amphidetus cordatus*, more particularly however *Annelida*, chiefly *Arenicola marina*.

The eggs of **Solea vulgaris** = c. 1,0265. — Corresponds to a salinity of c. 3,23 %—3.5 %.

The eggs of **Scomber** floated at a specific gravity of 1,0265—1,026. Corresponds to a salinity of c. 3,5 %—3,17 %.

Hensen (4. Bericht. 1884) states the specific gravity of the eggs of cod to be 1,0131 — at 17,5° = 1,72 % of saline matters.

It will be understood after these statements of the specific gravity, why many eggs of fishes are not carried into our smaller seas by the currents, but stop in the northern Cattegat. — The various sorts of pelagic eggs are indeed geographically distributed in the seas according to their specific gravity, and this of course influences the distribution of the grown-up fish. How great influence, I wonder, has this factor in the distribution of the lower animals? Cmp. my statements in »Hauchs Togter« (»General Results«) concerning the great influence of surrounding physical conditions on the distribution of the lower animals in the Cattegat.

*) Note. In »Nordisk Tidsskrift for Fiskeri« 1876, pp. 51—53 has J. Collin described some plaice from the Limfjord, which had a peculiar »ring« through their mouth. This ring, which is without any break, hangs loosely out of the mouth and through the gill-opening on the blind side, and is so strong that the fish may be carried in it without bursting it. It consists partly of various algæ, especially of the genus *Polysiphonia* (*Hutchinsia*) and strips of *Zostera*, partly of a tough animal mucus. — He calls these plaice »ringplaice«. —

Together with Dr. *Kolderup-Rosenvinge* I have once seen some of these fishes. which at certain places are not rare, in the Limfjord, and by means of the microscope the tough threads in the rings were proved to be byssus-threads of *Mystilus edulis,* which the plaice here eat in great numbers.

I suppose that the ring is formed quite »accidentally« by the breathing-movements of the fish, when long byssus-threads are hanging out of its mouth and can reach others which are hanging out of the gill-opening.

Whether all rings of these »ring-flounders« consist of this matter I cannot tell. Strange to say, I never saw them except in the Limfjord. (As to the details cmp. *Collin*).

In the German Sea I have seen large plaice quite stuffed with the large *Mactra stultorum*, which here evidently plays about the same part as *Mactra substruncata* on the northern Læsø banks. —

Plaice of the groups 1 & 2 seek, all of them, the same food as the grown-up fishes, though they cannot take the large bivalves on account of their small mouth; from this reason they often seek the fry and the smaller species of bivalves. The food of course is also highly dependent on the species of bivalves which live in the sea; at one place *Mactra* only are eaten, at another only *Corbula*, because no others are to be found.

The 0-group of the plaice, on the other hand, at first observes an essentially different diet. During their pelagic stage *Copepoda* evidently play the principal part; but in the month of *June* (on the sand-banks off Kjerteminde) I have found plaice of $1^1/_4$—$1^3/_4$ inch still living on *Copepoda, Cladocera, Ostracoda,* and *larvæ of bivalves.* In *August* when the plaice had reached a length of 2—$3^1/_4$ inches on the sand-banks off Kjerteminde, they had quite changed their diet, and were now eating *Idothea, Gammaridæ,* smaller *Annelidæ,* and *the fry of bivalves;* moreover they had much sand in their stomachs as the bigger ones also use to have. In the end of September, near Kjerteminde, when the fish were c. 3—5 inches long, they scarcely eat anything but young *Mactra* and young *Cardium edule*, so that they now in the main took the same sort of food as the older plaice. —

Of the other species of flat-fishes which from an economical point of view are of importance to us, I cannot give so detailed information with respect to their food in their various ages as I have given with respect to the plaice, but I can say at any rate that *Pleur. flesus* has much in common with the plaice. Both species live in the same manner and partly at the same places when they are young; but there is some difference when they are grown-up, *Pleur. flesus* preferring to live in the *zostera* regions and in muddy seas, while the plaice seeks the open seas with clean sand deposits. In the food, therefore, of the grown-up *Pleur. flesus* the fauna of the *zostera* plays an important part, and its principal food must be said to be *Rissoa, Idothea, larvæ of Tipulidæ, Annelidæ,* etc., bivalves, however, as the young of *Mystilus edulis, Corbula nucleus, Macoma baltica,* being scarcely less important. (See Biol. Stations Beretning I. 1890).

The food of the young *Pleur. limanda*, in the few specimens (c. 13^{mm} long) that have been examined, consisted of *Copepodæ* but of other species than those which the plaice and *Pleur. flesus* take; when older, it is particularly *Crustacea* and *Annelidæ* it seeks; it is far less greedy after bivalves than the plaice and the *Pleur. flesus.* Only with respect to the *Annelidæ Pleur limanda* may be charged with eating from the plaice. — In confinement *Pleur. limanda* is far more greedy after what little animals that may be offered it as food than the plaice; I never succeeded in making the latter eat anything whatever in the tanks on board. —

In contradistinction to the *species* of *Pleuronectes*, which live on lower animals, the *species* of *Rhombus* are *piscivorous when grown-up.*

The *young Rhombus maximus*, particularly, I have this year had the opportunity of examining on the sand-banks off Kjerteminde and on the other shores of Funen, where it was found together with the not yet one year old fry of the plaice (the 0-group). — The pelagic young ones of *Rhombus maximus* (and surely also the young *Rhombus lævis*) eat chiefly *Copepodæ* and such little animals, and in confinement they can easily be fed with them. — When, in the end of *July*, the fry is living on the sand-banks among the fry of plaice c. 1—2 inches long, I have in the stomachs of *Rhombus lævis* exclusively found *Mysidæ* of which I have often at this time of the year fished 1—2 stone in one haul with Ammodytes-seine. — In *August* I have found *Rhombus maximus* at the same places, 2—$2^1/_4$ inches long, also filled with *Mysis* and without any sand in their stomachs.

In the end of *September* I found a 2 inches long *Gobius* in the stomach of a *Rhombus lævis* which was $5^1/_2$ inches of length, so that the young *Rhombus* now towards winter, when the *Mysidæ* partly disappear, are able to take the same sort of food already as the grown-up fish.

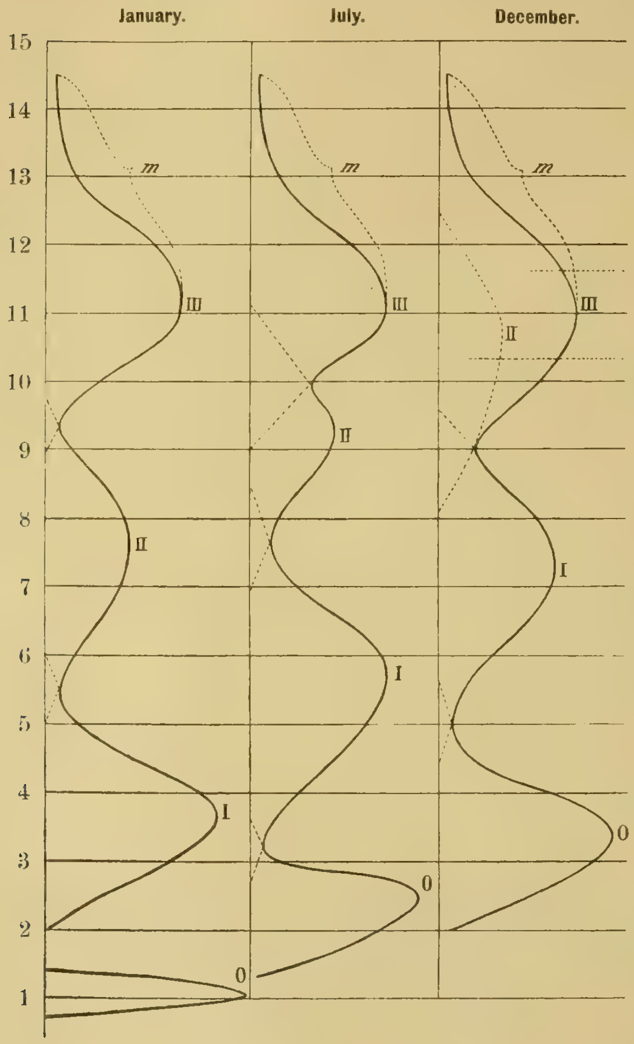
It is characteristic that the fishes of the genera *Rhombus* and *Pleuronectes*, though they are taken in the same haul, choose quite different food, the former swimming animals, the latter digging or creeping ones; only at their very youngest stages they take both of them *Copepodæ* and the like little beings. —

A Comparison between the growth of Pleuronectes platessa, Pl. flesus, and Pl. limanda, together with observations on the influence of the fishery on the same.

As indicated by the curves over leaf, representing *the growth of a triennial species of fish,* we shall, when we examine its size-groups, now be able to find 4 distinct groups (0, 1, 2, 3), now only 3, the groups 2 and 3 having been amalgamated.

It is only necessary just to mention that the 0-group represents all fish

Example of the growth of a species of fish, whose breeding-season occurs in the month of January, and whose individuals are c. 3 years in becoming „grown-up“.



m The constant curve.

All the fish that are more than 3 years old.

Fish 2 years 11 months old.

The line where the groups II and III are amalgamated.

younger than 1 year, the 1-group all fish between 1 and 2 years, and the 2-group all between 2 and 3 years; each of these groups is consequently in the main an annual series which, however, is often closely connected with the preceding and following annual series. The 3-group, on the other hand, does not only represent the fish between 3 and 4 years, *but on the whole all specimens over 3 years*. We might expect that this last mentioned group would contain an overwhelming number of specimens, but it does not seem to be so. As it has also always been supposed, the *mortality* of the *tender* fry (not to mention the eggs) must be great, and though it is difficult to avoid mistakes in making an estimate of the number, based on our enumerations, I do think I can perceive a decrease in number, for instance in the young plaice from their 1st to their 2nd and 3rd year, so that, for instance, the 1-group contains fewer specimens than the 0-group. But the reason of this might be that it is easier to catch the little fish, because they keep together on shallow water, so I shall not enter further into this question. —

While the groups 0, 1 & 2 are changed in size in the course of the year, the upper part of the 3-group will *always* be confined by a more or less *constant curve*. The lower part of the 3-group, on the other hand, is much changed because it is *amalgamated with the 2-group* at a certain time of the year. A line, where *this amalgamation takes place*, will be perceived at about 10 inches on the table. All specimens above this line may be called mature and *grown-up*, i. e. the specimens of the species longer than this have generally spawned once, or are just going to spawn, and they do not now grow so quickly that we can distinguish between the various annual series. The single individuals, however, may still grow, though perhaps but few of them do so, and only quite gigantic specimens reach 14—14$^1/_2$ inches. —

When we examine the size-groups of some species of fish in a certain sea, we will often find only one or two annual series there represented; the youngest annual series (the 0-group of the plaice is for instance quite missing in the parts of the Baltic Sea which we have explored (see table VII & VIII); the 1-group and, particularly, the 2-group are on the other hand abundantly represented; the 3-group is so scarce that we are compelled to believe in an emigration from the Baltic Sea of its specimens.

Something like this is the case also with *Pleur. limanda* (see table XI). Its 0-group is missing, as far as we know, in the Baltic Sea east of Falster and Sealand, and its 3-group is there exceedingly rare. The table shows also that the 3-group is not to be found everywhere in the Cattegat, while it is very numerous at certain places (column 1).

In the occurrence of *Pleur. flesus* (table X) we have an analogon to the various dwelling-places of the plaice and *Pleur. limanda* at their various stages of life. We find that the 0-group, but also the 3-group, of *Pleur. flesus* is abundantly represented in the Baltic Sea, while on the contrary the 1-group and, particularly, the 2-group are less frequent; yet they are more numerous there than in the Cattegat, where they are so rare that I have formerly supposed they lived in fresh water at this age (see *Beretning III, Dansk Biol. Station 1892,* p. 19). Its frequent occurrence in columns 1 & 2, table X, at the mouths of Mariagerfjord and Limfjord, as also at Gilleleje, and its scarcity in the northern Cattegat, where they are common when quite young, really indicate the same. Moreover *Pleur. flesus* is often seen immigrating into brooks, rivulets, and lakes, and are known to occur here in great numbers; but the question has never been examined with the above statements to help us. — It is possible after all that some of these *Pleur. flesus*, 1—2 years old, live in the *zostera* region, and from this reason generally avoid the flat-fish-seines; but in the Cattegat where seines may very well be employed, these annual series of *Pleur. flesus* are not found at all. That they occur in so great numbers at Bornholm is perhaps because they look upon the Baltic as by half a fresh-water sea.

That *Pleur. flesus* is not at home at any rate in the northern parts of the Baltic Sea seems evident from *R. Lundbergh's* statements p. 464 in »*Trawl Net and Beam Trawl-Fishing. 1885*« where he says that *Pleur. flesus* only in very exceptional years, for instance 1883, occurs in the northern parts of the Bothnian Gulf, »where this fish is else not known and where he do (does) not appear in every tenth year«.

Something like this is said also of the *cod* and *C. scorpius* which both of them have pelagic young ones like the flounders.

Though thus the 0-group of *Pleur flesus* is known in the Baltic Sea, while that of the plaice chiefly lives in the Cattegat and the Belts, it does not seem that *Pleur flesus* is able to breed in quite fresh water or in the northern part of the Baltic Sea. Investigations into this matter, particularly information as to the occurrence of eggs in fresh water, would be very desirable*).

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*) Note: Not till then can we judge of the value of *G. Duncker's*: »Der Elbbutt eine Varietät der Flunder«; for though we may find specimens of *Pleur. flesus* with »vollständig gereiften Geschlechtsprodukten« and »ganz junge Exemplare« in the Elbe, this does not prove that young ones can come out of the eggs, or that the young ones that have been found come from the fresh water. He himself has seen no young ones which had not already grown unsymmetrical — says he.

We may easily in tables X & XI as also in tables I & II (in *Beretning Biol. St. III*) with respect to *Pleur flesus & limanda* find something which may be called the *constant curve* (see the table p. 32), that of *Pleur. limanda* reaching from c. 8—12 ($13^1/_2$) inches, that of *Pleur. flesus* from c. 10—$14^1/_2$. The *latter*, however, is much more common (see table) than the *former*, and by glancing over the headings of the columns we shall see that the curve of *Pleur. flesus* is found almost exclusively in the fjords, the Belts, and the Baltic Sea, rarely in the open Cattegat where *Pleur. flesus* goes only in the breeding-time.

As to *Pleur. limanda* the curve certainly occurs in the open *Cattegat*, the proper dwelling-place of this fish, but very rarely only compared to the great numbers of younger fish; but off the mouths of Mariagerfjord and Limfjord (near the shores consequently), in the Lesser Belt at Fænø, and in the little seas around Samsø the 3-group plays a greater part. All these places are so situated that fishery with plaice-seine seldom, if ever, is carried on there. At Fænø, however, the plaice-seine was introduced in 1891. The open parts of the Cattegat, particularly north of Grenaa-Kullen, are as it is well known the proper place for this fishery.

On the other hand, it must be owing to emigration, evidently, that the 3-group of *Pleur. limanda & flesus* is not found more numerously by the frequent explorations in the *Baltic Sea* east of Falster and south of Sealand. —

I have worked very much in order to find the situation of the constant curve with respect to the plaice (see table II—VIII). Table I, which shows the fishermen's takes, and often represents the single big fishes picked out of a great number of specimens, can from this reason not be employed for this purpose.

It will be in vain in these seven tables to look for something like a decided 3-group; the nearest approach to it is found in the Great and the Lesser Belt and in the Baltic Sea, and the group is here generally either the result of long time's fishery (Kjerteminde, Fænø), or it is not very numerous, as in the Baltic Sea (or perhaps, in part, not so old as it has been supposed to be).

It is remarkable *that no such 3-group can be pointed out in the Cattegat (and the Limfjord);* and the fishermen have told me (and proved also in deed) that they too have been unable to do so, in March 1892 (table VI, column 8), though the whole fishing-fleet searched most eagerly; yet, after all, it is seen in table I that large fishes are to be found in the Cattegat in smaller numbers.

When, therefore, the 3-group is missing in the Cattegat, the reason must be that the large plaice are not numerous enough to show the same;

for there must grow up a 3-group if the plaice is left to itself. We may draw this conclusion, partly from analogy with other fishes *(Pleur. flesus & limanda),* partly because we can trace such a one already in the seas towards the south, *where the plaice-fishery is not carried on very much.*

In order to see how the plaice look at spots where for years there has been no intense fishery, I got measurements of plaice from the *Icelandic fjords* (table IX). They have been caught by the fishermen in plaice-seines with large meshes, exclusively in order to catch as many and as large fishes as possible in the shortest possible time. The small annual series, 0 & 1, are therefore not represented at all in the table (they go through the meshes), and the 2-group is scarce too, as the fishermen, of course, have searched most for the 3-group. I cannot prove that it is the latter which is so strongly represented in table IX by fishes of c. 17—29 inches; but it must be the 3-group I suppose, if the plaice have not a 4-group — and there is nothing to indicate that.

To prevent any mistakes, I shall add that while the plaice in table I are often *picked out* among a great number of fishes, consequently not representative of any seize-groups as these occur in nature, the fishes in table IX are measured promiscuously just as they came up with the seine. Only, as the latter had large meshes, the specimens smaller than c. 8—10 inches were not caught.

In some of the Icelandic fjords then there is a 3-group, but is it missing in the Cattegat. We might *suppose*, certainly, that it emigrates from the Cattegat, as it seems to do from the Baltic Sea and the Limfjord, but this supposition is very improbable, 1) because we still find traces of a 3-group in the Cattegat in such large fishes as do not in size follow immediately after the 2-group, but are much larger (21—22 inches long) — (see table I); these large fishes are found at places where till this day the plaice-seine has been least used, because the water has been, now so deep, now filled up with stones on the bottom; 2) we can remember that the plaice a few years ago were larger in the Cattegat than they are now. — The latter is a fact everybody has observed who has had anything to do with this matter for some years; nay, the consumers who only eat the fish can tell us so. But it cannot be proved with figures, nobody, as far as I know, having written down 10—15 years ago what the plaice used to weigh in the Cattegat — nor have the fishes been measured*).

I am sorry this has not been done; for I am now obliged to believe in this and to show how well it agrees with the phenomena which otherwise will be brought to light to explain this matter.

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*) Compare however Chapter II later on.

When the 3-group of *plaice* and *Pleur. limanda* is so scarce in the Cattegat, compared partly to the Icelandic fjords with respect to the former, partly to our enclosed-seas, I think *the reason is that it has been fished up, the plaice on purpose*, in order to sell it, *Pleur. limanda* chiefly *unintentionally* as this fish is of very little consequence as a commodity. As *Pleur. limanda*, however, is rather a delicate fish, the individuals are generally killed while they are caught; but *Pleur. limanda* is, partly, smaller than the plaice, partly it has not been pursued intentionally, the result of which is that it has not suffered so much as the plaice, so that it can still produce a 3-group at several places.

Pleur. flesus is not pursued with the large vessels, as it lives more inshore, also because it is nearly worthless in the wholesale trade; from this reason, among others, this fish is so often represented by its 3-group; its way of living (i. e. that it lives in fresh water) might perhaps also be conducive to this phenomenon.

The lemon Dab *(Pleuronectes microcephalus).*

During these fishery experiments in the Cattegat have, in all, only 3 young ones of this species of fish been caught. They were $4^1/_4$, $4^1/_4$, and $4^1/_2$ inches long, and were caught in the northern Cattegat, as far as I know not on particularly deep water, and on hard bottom. — Quite *ripe fish*, with ripe spawn and milt, I never saw in the Cattegat; but it seems that the spawning-time occurs in the month of June or thereabouts; after that time many spent fishes were seen, before that time many nearly ripe ones. It seems doubtful to me whether it spawns in the very Cattegat in greater numbers.

With the above exceptions I have not succeeded in getting any specimens smaller than c. $9^1/_2$ inches in length, and those above this size seem all to have been mature. If little specimens were living in numbers in the Cattegat, we must have found more of them with our seines (which had small meshes), though the young ones of this flat-fish are able perhaps more easily to avoid the seines than for instance those of *Pleur. cynoglossus*, as the species, I suppose, lives most on hard bottom with stone, where it is impossible or at any rate time-wasting and difficult to draw seines *).

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*) Note: *Cunningham* (Jour. Mar. Biol. Ass. 1891, p. 113) seems most inclined to think that the young ones live on deep water and from this reason have not got into his fishing-gear near Plymouth.

The fishes mentioned in the tables have been bought from the fishermen and are all of them caught in the deep northern and eastern Cattegat, with seines as well as with nets, generally on 10—20 fathoms of water.

Pleur. microcephalus, evidently, does not seek so deep water as *Pleur. cynoglossus;* but like the latter it does not live in great numbers in the southern Cattegat or in our smaller seas. The principal fishing-place for it is Frederikshavn. The males seem to be a little smaller than the females, both with respect to the average and the maximum size.

From the shores of Norway we know little young ones of this fish. On the shores of England its little young ones are rarely caught in spite of all exertions. (See *Williamson:* 11. Report Scot. Fish. B. pp. 271—73). *E. W. L. Holt* and *H. C. Williamson* state its spawning-time on the English shores to be May—Septbr.

The pole Dab *(Pleuronectes cynoglossus).*

Rather considerable quantities of *Pleur. cynoglossus* are yearly carried to Frederikshavn, caught in the deepest parts of the northern and eastern Cattegat on soft clay deposits, as for instance north and east of the Skaw, in Læsø-Rende, towards the Swedish coast, etc. Farther southwards it is scarce.

During the present researches it has been fished only a few times; the specimens in the tables have all been bought from the fishermen.

Already *Krøyer* calls the attention to the fact that *no young ones of this fish are to be found in the Cattegat,* and I never saw any specimens from this sea smaller than 10 inches. *Pleur. cynoglossus* seems to be a *deep-sea fish* which, as a rule, does not breed at all in our seas.

Judging from the development of the sexual organs in spring, it does not seem unlikely that its spawning-season occurs in summer, as it has from various sides been stated to do. Its young ones are known from the shores of Norway on deep water (*Lilljeborg*, p. 393) and from the shores of Ireland on 80 fathoms of water (see *Holt:* Survey of Fishing Grounds, p. 343). It is seen from the tables that also the males of this species are somewhat smaller than the females with regard to the average as well as to the maximum size. I do not know ever having heard any complaint of a decrease in size and number of this species of fish in our seas, which agrees well with the supposition that it is not till it is grown-up that this fish enters our seas from the deeper regions (the Skager Rack) where it is not pursued by the fishermen or at any rate only very little.

It prefers particularly soft clay deposits, wherefore *Fabricius's* name *Pleur. saxicola* fits it very badly.

The Halibut *(Hippoglossus maximus).*

On basis of my own investigations I can say here only with respect to the halibut that young ones, somewhat smaller than two feet, are pretty often caught in the northern Cattegat.

Large specimens of this fish have during these few decennaries become more and more scarce in the Cattegat. It evidently requires a long time to become »full-grown«.

The 24. March 92 I saw a male of 20 inches and two females of 14 and 16 inches in Frederikshavn; they were all without ripe milt or roe.

The long rough Dab *(Drepanopsetta platessoides).*

(Syn: *Hippoglossoides limandoides.*)

A great number of *Drepanopsetta platessoides* have been measured during these investigations (see table XIV), and none of them have been bought of the fishermen, who always throw away these fishes as of no value. Only one of the specimens that were caught was smaller than 3 inches; perhaps they go through the meshes of the seines at this size and smaller, for the young fish are very narrow. Also in England and Scotland the young ones seem to be very little known. *Lilljeborg,* however, mentions a young one in »Sveriges och Norges Fiskar«.

Besides the grown-up fish (females) which, rather remarkably, have been found only in small numbers, we can find in the table two distinct annual series. The youngest series (in the table a little more than one year old) is in the spring 1893 represented in column 8 from Læsø-Rende (26. April) by specimens of ($2^3/_4$) $3^1/_4$—$4^1/_2$ inches; it is seen later on to grow in the course of the summer and autumn. This series, the youngest we know, is always caught on deep water (10—38 fathoms), and most numerously on the deepest water. — Of the fry from the winter and spring 1893 I have in 1893 been unable to find any trace anywhere in the seas. It must also, I think, live on deep water; on shallow water it is certainly not in our seas. That it should not live here at all is not likely, I think, as the one year old fry is found in our seas as far into these as the northern parts of Funen and perhaps farther. It is remarkable too, however, that we find so few males of these fishes in our seas; yet, according to *Fultons's* investigations on the coasts of Scotland, this seems to be the rule there also.

The next series (a little more than 2 years till $2^1/_2$ etc.) is very common in the tables, and is nearly always caught together with the younger series; it extends in summer over specimens between c. 5—8 inches, *but neither this nor the younger series has at the same time quite the same size everywhere in the seas:* there is for instance a perceptible difference in the size of the series in the month of July (both in 1892 and in 1893), so that they seem retarded in their development (particularly the younger series) in the deep seas of the northern and eastern Cattegat (see in the table columns 5, 11, 12 from »East of Læsø 27—38 fths. 1. July 92«, »The Skaw 33 fths. 7. July 1893«, »North of Anholt 21 fths. 21. July 1893«) compared to the other places, which are all of them either situated on much shallower water or at any rate (Læsø-Rende) situated in such a way that the hydrographical conditions are essentially different from those of the former places.

The deep places will be influenced by the summer temperature much later in the year and then in a much slighter degree; the winter temperature on the other hand is not so low at these places. Whether now this circumstance is decisive in this question I cannot tell, but the hydrographical conditions are on the whole very different at the said places.

Among the specimens between $7^3/_4$ and 13 inches I have found several which had evidently lately spawned in spring, to judge from the large, empty ovaries; a single female with running roe was found as late as 5. April 1893 at Kjerteminde. I must think, therefore, that their *breeding-season* occurs in winter and early spring; this agrees also with Scotch statements.

Why the large specimens are so rare is a question which has occupied me much after my attention had first been called to it; this was not immediately; as this fish plays such a small part in our fishery I originally took but little heed of it.

I do not know that I have seen any males larger than 8 inches; *Fulton,* however, states 12 inches to be their maximum size (10 Report Scot. Fish. Board, p. 240, table). The females on the other hand become much larger, in our seas as large as 13 inches, according to investigations by *Krøyer* and myself.

This relation between the sexes, that the males are so exceedingly rare and much smaller than the females, so that the mature females, c. 8—13 inches, are generally larger than the males ever become, is something quite exceptional among our flat-fishes. *Fulton* states that both males and females are able to breed with a length of 5 inches.

The large specimens of *Drepanopsetta platessoides*, just as well as the small ones, live on deep water; in the Cattegat, therefore, on the soft clay deposits, and in our smaller seas on the mud deposits which are often covered with decaying *zostera*, and rather stinking. Without becoming rare this fish goes down as far as into the western part of the Baltic Sea.

I do not feel sure at all that I have explained the annual series of this species of fish correctly; to do so I had too few specimens both of the grown-up fish and the quite small ones.

The Turbot *(Rhombus maximus)*.

We have succeeded during these investigations in finding this *year's fry of Rhombus maximus* in great numbers on shallow water where it lives together with the young plaice, *Rhombus lævis,* and *Pleur. flesus.*

Already before this I have observed *the pelagic young ones,* which are considerably larger than most others of our pelagic young flat-fishes. I have seen these in the open Cattegat as well as in the harbours of this sea, and I have seen them also in the Great and the Lesser Belt. *They do not seem, therefore, to be so exclusively dependent on a high salinity as the plaice are.* This year (1893) young ones of 1893, $^1/_2$—4 inches long, have been found in multitudes on the shores of the Cattegat, in the Belts and the Sound, nay on the Baltic shores of Lolland and Falster; even at Bornholm they have been found in great numbers. All these places are situated on *open* shores; we have not met with these little young ones in the fjords. This fry did not appear till the month of June and July and particularly in August—October, which agrees very well with the fact that the spawning-season of *Rhombus maximus* occurs in the months of May—July in our seas; in October they had reached a length of 1—c. 4 inches. (See table XV.)

In spring, as late as the month of June, only a few young ones, 3—5 inches long, had been found on the open shores; these must belong to the fry of 1892, and were consequently 1 year old. As just mentioned only a few were found, between c. 3 and 5 inches, and they could scarcely represent the whole annual series of 1892, most likely they were only »retarded« specimens; where the rest of this annual series lives I do not know, as it has not been possible for me to fish many specimens of such sizes, c. 3—6 (7) inches, as may be supposed to be one year old. I must suppose that this annual series lives at places where the fishermen generally do not fish for them, and where I have not been able to draw the seines on account of stones or too much vegetation*).

I do not think these small fishes live on very deep water, for young specimens of *Rhombus maximus,* a little larger, c. $8^1/_2$—$10^1/_2$ inches, are not rare in our fjords. (See table XV, column 11 from Gamborg Fjord.)

The two years old fishes I must look upon as represented in the Cattegat by the specimens of c. 6(7)—10 inches; they are very common (see the table) in the S. W. Cattegat, in Gamborg Fjord, and the Baltic Sea at Bornholm. Specimens from the Cattegat between $10^1/_2$—17 inches must, I think, be looked upon as a third annual series. As to the age of the larger specimens, I shall say nothing; perhaps there is a 4th series.

Fr. Day says (»British Fishes«) that young ones of *Rhombus maximus*, 3 inches long, in the Southport Aquarium in the course of $2^1/_2$ years reached a weight of 10 lbs. each, in $4^1/_2$ years 20 lbs. These statements agree very well with the above; but so many opinions have been set forth with respect to the weight of fishes, that we scarcely know what to think; and, sure enough, they do grow very differently under different circumstances.

The largest spawner I have measured is $30^1/_2$ inches long; the milters do not appear to grow so large.

Quite remarkable is the numerousness of the smaller specimens in the Baltic Sea and the Belts; might not this indicate an emigration of the larger ones from these places to the Cattegat? (See under The Plaice.)

This species of fish is supposed to have decreased in a still more alarming degree than the plaice; its average size, particularly, is diminished,

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*) *Cunningham* struggles with the same difficulty. My above supposition with respect to the size of the first annual series agrees however very closely with his measurements (from *Concarneau*) of specimens of *Rhombus maximus* brought up in confinement, c. 2—$7^1/_2$ English inches in the first year and c. $7^7/_8$—11 in the second (»I. M. B. Ass. Plym (N. S.) vol. II«, p. 357).

perhaps not its number. *Rhombus maximus* becomes sexually mature in our seas with a length of c. 11 inches, in the Baltic Sea perhaps even smaller. It is found with ripe roe and milt in the Cattegat as well as at Bornholm, but in our smaller seas (the Belts and the Sound) and more southwards I never saw its spawn floating in the sea in large quantities; I have there met with many more young ones than ova. The latter evidently require a high salinity in order to float, and are said to be inclined to sinking at a certain stage in their development. (See *Holt:* J. M. B. Ass. Plym. (N. S.), vol. II, pp. 399—404). The *spawning-season* occurs in May—July, and ripe fishes are not uncommon at that period, as they seem to be on England's shores. Not till lately they have there learnt to know its eggs (see *Holt:* loc. cit.); I have here in Denmark known them for many years.

Rhombus maximus is caught far into the Baltic, and is even rather common in Stockholm's Skærgaard (*Lilljeborg* p. 317); it must therefore be supposed to undertake long migrations; for at Stockholm they are certainly unable to breed.

Rhombus maximus does not become much longer than *Rhombus lævis* (c. 31 inches), but as it grows older, it increases quite remarkably in weight and thickness. It often reaches a weight of c. 25 lbs.; if it is lean it weighs much less.

The Brill *(Rhombus lævis)*.

The tender fry of *Rhombus lævis* from 1893 I have not found by far in such great numbers as that of *Rhombus maximus;* some specimens however were found in the months of July, August, and September, betveen $^3/_4$ and $3^1/_2$ inches long, in the Cattegat as well as in the Belts and at the isle of Møen and at Gjedser, but none at Bornholm, where *Rhombus maximus* is common. They were found together with the fry of the latter, on clean sand bottom and quite shallow water.

Of the larger fry (from the previous year), on the other hand, there were, remarkably enough, found proportionably more individuals than of *Rhombus maximus* of the same age (see table XVI); they were c. 3—6 inches in spring, and were found on rather shallow water near the shores. I do not know, however, whether this is the ordinary dwelling-place for this annual series; to know that I have too few details.

The specimens of c. 6—$10^3/_4$ inches may perhaps be looked upon as the two years old ones. *Rhombus lævis* is becoming ripe with a length of c. 11 inches. A third grown-up (mature) annual series and perhaps a fourth are most likely represented by the specimens from c. 12--23 inches. The milters do not seem to reach the spawners in maximum seize, nor do they reach them in average size. The largest spawners I have measured are c. 26 inches, the largest milters only c. 23. The fish is thus scarcely as large as *Rhombus maximus*, and particularly not so weighty.

The spawning-time agrees with that of *Rhombus maximus:* May—July; in that period spawning individuals are not rare in the Cattegat. Its eggs are larger than those of *Rhombus maximus.* Also this fish is said to have suffered much from the too eager fishing in the Cattegat in these later years.

It is scarcely so numerous in the Cattegat as *Rhombus maximus;* in our narrow seas in towards the Baltic, it is at any rate much rarer, and in the Baltic Sea it is found even far more rarely than *Rhombus maximus.* It will be perceived that the 2nd annual series of this species of fish, like that of *Rhombus maximus,* is particularly abundantly represented in the seas about Grenaa where they are fished much with gill-net. This may be looked upon, perhaps, as a parallel to the fact that the younger annual series of the the plaice (not the youngest though) in our inward seas (particularly in the Baltic east of Sealand and Falster) were so numerous, and that the older fish must be supposed to emigrate from this place to the Cattegat.

The Norvegian Topknot *(Zeugopterus norvegicus)*.

Of this rare flounder, which is of no value for the fishery, two specimens were taken during these investigations, both east of Læsø, on the 1. July 1893, on a depth of respectively 27 and 38 fathoms. Our two other species of this genus, *Z. megastoma* and *Z. punctatus*, are very rare; nay, I have seen only one single little specimen of the latter in the Cattegat in these 10 years, and the former I have never found. They are of no interest at all to our fishery.

The Megrim *(Arnoglossus laterna)*.

24.	June	92	were found	2	specimens	N.	of	Anholt lighthouse	on	10	faths.	of water.
29.	—	-	—	1	—	East	-	Hirtsholmene	-	14	-	—
-	—	-	—	6	—	N.E.	-	—	-	8	-	—
-	—	-	—	2	—	N.W.	-	—	-	4	-	—
1.	July	-	—	1	—	East	-	Læsø	-	6½	-	—
-	—	-	—	23	—	—	-	—	-	10–15	-	—
-	—	91	—	46	—	½ Dan. mile NW.	of	Kobbergrundens lightship	-	10	-	—

The latter 46 specimens were caught in one haul with the seine (see table XVII)

It seems that there is here an indication of a younger annual series besides the grown-up mature ones, at any rate of the males. The females had ripe spawn, quite ready to be shed. The eggs had a pale oil-globule, and were estimated *without a microscope* at between $^1/_2$ and $^3/_4$^{mm} in diameter.

The males, at any rate the larger ones, were, I presume, also mature.

1886 I had onboard the »Hauch« taken 5 specimens of this little flounder in the southern Cattegat.

Strange to tell, it was not found again in the Cattegat in 1893 by *Bay* and *Hansen*.

This fish is practically of no importance to our fisheries.

It is not likely I think, that such a small fish as this requires three years in order to be developed, such as the larger species do; it will be fair, therefore, to attribute to it two annual series (see table XVII), the first annual series, and the second or the grown-up fish.

The Sole *(Solea vulgaris)*

The sole is a very common fish in the Cattegat; a considerable fishery is carried on for it both in the northern and in the southern part.

At certain times of the year, in the summer, the soles approach the coast; they go into the Issefjord, for instance, in the months of May—June, and produce in this time ripe spawn; whether the latter is shed there I do not know for certain. Also after the spawning-time the grown-up soles will live on the shores of the Cattegat on shallow water. In winter, however, they are found on the deep only, on the soft clay deposits, in which, according to the fishermen's statements, they lie bored down, so that the men must make the seines cut deeply down into the clay in order the catch them. — The night is said to be the best time for the fishing of soles, and I must believe that it is so; for in all our hauls we have only exceptionally got any soles, and all the draughts were made in the day.

The specimens we have measured (table XVIII) are, with exception of the little ones, bought of the fishermen; they are said to catch much smaller specimens than these at other seasons, viz. when they employ seines with small meshes particularly adopted for soles; but such fishery could not pay at the time when I studied this matter, and was consequently not carried on. The fishery for this fish is said to have decreased much, just because it was pursued so eagerly with seines with small meshes.

The female soles (as will be seen from the tables) are already able to spawn when they are c. 9 inches long, so that all larger than that as a rule may be called grown-up; the largest ones are c. 18 inches long. The males are less numerous than the females and altogether somewhat smaller.

I have succeeded in finding only proportionally few soles smaller than 9 inches, so that I cannot with certainty speak of their growth and age; it appears however from the table that the fry of the year in August—October is from $^1/_2$—2 inches long and lives on the more shallow, sandy beaches together with other young flat-fishes. The spawning-season occurs in May, June (and July), so that these little ones are very young. Specimens of 3—5 inches I have got at the same places in small numbers already in the foresummer; they must have been born in the preceding year, and are consequently c. 1 year old.

I must suppose that, in analogy with several other flat-fishes, there must be one annual series more (between c. 6—11 inches in length), before we reach the grown-up fish, and that the sole thus requires 3 years to attain maturity. Where this series, the 2-group, lives I cannot tell; but it must doubtless be found in the Cattegat, most likely on deeper water.

Little young soles, partly pelagic ones, have during these investigations been found as far south as Kjerteminde and Fredericia; they were found only in small numbers. Grown-up soles are in these parts, as on the whole outside the Cattegat, so rare that many old fishermen do not know them at all.

On account of this scarce information of the younger series of the sole, I am unable to decide whether the Cattegat contains a really *independent* stock of soles, or whether, perhaps, it is quite dependent on the Skager Rack in that respect.

Also from the English shores we have only scarce information of the fry of the sole. *Cunningham* (loc. cit.) supposes that it is not so absolutely dependent on the shore as for instance the fry of the plaice, which supposition seems to agree with my observations. On deeper water such fry can more easily remain undiscovered by the investigations than on quite shallow water, which perhaps is the reason why it is so scarce in the table.

The red Sole *(Solea lutea)*.

4 specimens of the above-mentioned little species of the sole, $1^3/_4$—3 inches long, were found among fry of *S. vulgaris* which in 1884 I had gathered at Frederikshavn.

On the 13. July 92 I found a specimen, $4^1/_4$ inches long, east of Læsø on 8 fathoms of water; further, in 1893, a specimen of $3^1/_4$ inches was found by the »Hauch« on the 8. July, 4 Engl. miles E. N. E. of Aalbæk on 5 fathoms of water, and 2 specimens of $3^1/_8$ and $2^3/_4$ inches were taken in May in the northern Cattegat by *Bay* onboard the »Hauch«. It is known also from the Jutland shores of the German Sea. — This little species of the sole is practically of no importance at all to our fishery; but it is easily mistaken for fry of the common sole.

Chapter II.

Why is the profit of the flat-fishfisheries decreasing in the seas east of the Skaw?

Because the fishing is carried on too eagerly.

That the plaice-fishery **east of the Skaw** has decreased considerably, so that *the capital that has been invested in it does not yield so high interest as before is,* I am sorry to say, an undoubted fact, evident to all who have had anything to do with this fishery.

It is generally said that the reason of this is a deterioration of the stock of plaice owing to the eager pursuit; but we might imagine also that in the course of the years *too great a capital* had been invested in this fishery, so that the latter *is unable to bear it,* though perhaps the stock is as good as ever it was.

If this were really the case, legislature must leave the whole matter to itself; at most, people might be advised to invest their capital in other enterprises; but evidently it is not so, at any rate it is *not the only cause of the depreciation.*

If the stock of plaice east of the Skaw were as good as it used to be, the market, with the present great number of fishermen, would be as well supplied as before, nay better indeed; but this is what does not take place.

The market for our flat-fishes which have been caught in the Cattegat is partly *our own country*, partly and particularly *Germany* (Hamburg-Altona), partly, in a slight degree, *Gothenburg* (for the sale of the little plaice).

Our principal home market is *Copenhagen*, and here all *consumers* complain of the enormous prices of plaice (30—40 Øre [4—$5^1/_3$ d] per lb.) as also of the difficulty of getting plaice at 20 lbs. the score and upwards. In both respects they were better off a few years ago.

In *Altona* the annual statistics of the sworn auctioneer shows *that the quantity of fish sold by auction reached its maximum in 1890 with respect to plaice »aus Skandinavien«,* i. e. principally from the Cattegat and partly from the German Sea at Jutland. There were sold then c. 350,000 lbs. In 1891 were sold c. 220,000 lbs., in 1892 c. 130,000 lbs., in 1893 only c. 50,000 lbs. The part which is not sold by auction has scarcely decreased in the same degree, but as it is just the fish that is not particularly in demand which is sold by auction, so to speak the quantity only which is not necessary for the fixed daily consumption, the auction shows excellently whether the supply increases or decreases; *it shows it in a somewhat stronger measure**).

From Gothenburg I have no further details of the supply of the market.

The said markets (Copenhagen and Hamburg-Altona) are supplied however with plaice »aus Skandinavien« not from the Cattegat only, but also from Scandinavian fishermen in the German Sea and the Skager Rack, and yet they show such a decrease.

In order to form an opinion of the fishery at fishing-places which are quite, or at any rate chiefly, dependent on the plaice-fishery in the Cattegat, I have from the harbour master at *Grenaa* and from the custom-house officers at *Gilleleje* obtained statistics of the fishing-vessels that have entered the harbours during these later years. The statistics from *Grenaa* show how many times fishing-vessels that are liable to do so have paid harbour-dues, which are paid for a week at a time. Those from *Gilleleje*, on the other hand, give the dues paid by the fishing-vessels in Kroner.

Grenaa.	The year.	Fishing-vessels.	**Gilleleje.**	The year.	Dues.
—	1876	62			
—	1877	100			
—	1878	246			
—	1879	390			
—	1880	243			
—	1881	173			
—	1882	193	—	1882	79 Kroner
—	1883	358	—	1883	110 —
—	1884	467	—	1884	109 —

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*) Altona is the particular market for the large plaice, while Gothenburg is the same for the small ones.

Grenaa.	The year.	Fishing-vessels.	**Gilleleje.**	The year.	Dues.
—	1885	781	—	1885	161 Kroner
—	1886	956	—	1886	350 —
—	1887	1225	—	1887	458 —
—	1888	1334	—	1888	475 —
—	1889	1769	—	1889	542 —
—	1890	1996	—	1890	498 —
—	1891	1458	—	1891	533 —
—	1892	954	—	1892	294 —
—	1893 $^{1}/_{1}$—$^{30}/_{11}$	823	—	1893	424 —

At Gilleleje other fisheries, as for instance the herring-fishery, are of great import beside the plaice-fishery; but both here and, especially, at Grenaa there is evidently *a culmination about the year 1890, the same year as the culmination at Altona.*

These statistics are not set forth here in the hope that they will convince anyone who doubts that the stock of plaice is decreased in the Cattegat, but only to give a hint to those who will look forward to future times with the view of the matter which I have got by and by while studying these things on sea as well as on land.

For, how are we able, without accepting the supposition of a decrease, in certain respects, of the stock in the Cattegat, to explain the *diminution in the number of* **saleable** *plaice which a cutter can fish in one day on the formerly good fishing-grounds* at Læsø, in the Aalborg cove, nay even in the German Sea (the Skager Rack on the shores of the northern Jutland)? See, as to this question, the official statistics for 1891, p. 36; it shows, for a series of years, a considerable diminution in the *daily* fishery till about half of what it was before.

How, finally, are we to explain *that our plaice-markets are not quite overstocked*, when we know that both the number and the size of the fishing-vessels in these 15 years have been considerably enlarged; that the fishing-power of their gear has been doubled many times by means of long lines on the plaice-seines and steam-winches to haul these in; that the number of fishing-grounds has been extended from rather a small part of the Cattegat till the whole of this sea, where plaice are living and where stones do not make it impossible to draw the seine, and that moreover, the Skager Rack, from the Skaw along the western shore of Jutland as far as the Limfjord, has been included in the fishing-territory of our plaice-cutters?

The fishing-grounds have become several times larger than they were

15 years ago and the fishing-power is certainly 20—30—40 times as large now as then — and yet the market is not even fully supplied; we might have expected it would have been overstocked many times. Nor do the official statistics show any corresponding encrease in the total profit of late years. (See pg. 56.)

And then, how are we to explain that the same men who have long been so satisfied with the excellent fishing in the Cattegat, now equip cutters in order to go to Iceland and fish for plaice there, in spite of the great risk which is always attached to the first experiments in that line?

How are we to understand that the large plaice (the 3-group, the grown-up ones) have become so rare in the Cattegat, if we do not suppose *that the stock of plaice has formerly been of such a nature that it was better able to supply the market with fish, than it is now?*

We must believe that the reason of the complaints of the plaice-fishery is not only that too large capitals have been invested in it, but particularly *that the productivity of the very stock must have been diminished.* —

There are those who will say, perhaps, that there is no reason to mind these complaints: all fishing is subject to fluctuations of which man is not master; the plaice-fishery will certainly be better again some day without our help — nay, we *can* do nothing which will really be of any help for it — and they will no doubt refer to fluctuations in the fishery of herrings, of mackerel and garfish, of cod, etc.

To these opinions, however, we can offer the following objections:

1) The plaice (and all other flat-fishes, I suppose) is in certain biological respects very different from the said fishes, so that we cannot without further ceremony draw a parallel between them; the latter are generally migrating fish, the plaice rather stationary ones.
2) Such migrations which might be thought to decrease the stock of plaice to a very great extent in all seas east of the Skaw, have not been known before, as with respect to the herring, mackerel, etc., nor have they evidently taken place now; for in that case they must (as stated above) have influenced the large fish only; as it is the number of these only which we know to have been diminished of late years, while the smaller fish to this day live in our seas in multitudes, nay perhaps even in greater numbers than in former years, when there were more large ones to take up the room.

3) Nobody ever pointed out any reason for such a thorough emigration of the large plaice from the Cattegat and the smaller seas, and I never heard such migrations mentioned by people conversant with these matters.

4) On the other hand: if we suppose that *it is the very fishery, carried on too eagerly during these later years, which has done away with the larger plaice,* then we have a simpel and very probable explanation of all particulars concerning this matter, viz. a) the diminished productivity of the stock of plaice, and b) the diminution in size of the plaice.

I shall in the following enter more closely into the details of this supposition. —

As the reader will have perceived from the tables of the fishing-vessels at Grenaa and Gilleleje harbours (see *ante* p. 49—50) the whole rapid development of the plaice-fishery has taken place in the course of these 10—15 years; there are now fishing in the Cattegat c. 200 cutters besides the open boats.

Frederikshavn which is the principal place for our plaice-fishery shows this advance excellently, there being in the year

1876	41	cutters	belonging	to that town.
1877	43	—	—	—
1878	44	—	—	—
1879	45	—	—	—
1880	53	—	—	—
1881	59	—	—	—
1882	60	—	—	—
1883	60	—	—	—
1884	65	—	—	—
1885	70	—	—	—
1886	70	—	—	—
1887	72	—	—	—
1888	85	—	—	—
1889	94	—	—	—
1890	103	—	—	—
1891	110	—	—	—
1892	112	—	—	—
1893	116	—	—	—

The fishery from Frederikshavn is now (as it is well known) carried on not only in the Cattegat but also in a part of the Skager Rack and the German Sea as also at Iceland; if limited to the Cattegat only, as at Gilleleje and Grenaa, these figures would have turned out not a little different for the latest years.

The way of fishing has of late years been changed from fishing with *gill-nets* to fishing with *seines* (plaice seines, Dan. »Snurrevaad«), which are drawn by means of long lines (one on each arm of the seine), and generally by means of a steam-winch; in so doing they have given up an *older*, *troublesome* way of fishing for a later and intensive one, so that I dare say the fishing-power in these years has been doubled 20—30, nay perhaps 100 times.

If we took the lines from all the plaice-seines which are now in use, and tied them together into one long line, this would reach more than double the length of the Cattegat, the lines in use being often 600 fths. long on each arm of the seine. In other words, if there were nothing else to prevent it, one might take almost the whole Cattegat in one haul of the seine. And now every cutter makes not one but many hundred hauls in every fishing-season. Is it any wonder then that the result of such a fishing is a perceptible diminution in the number of the fish which can be caught in the seine? These are almost exclusively flat-fishes; the seine is made on purpose of these, and it catches them splendidly. Other fishes, as cod or haddock, not to mention herrings, etc., are seldom if ever caught in these seines in greater numbers.

While 15 years ago plaice-fishery was carried on only at a few of the shallowest places on the shores, and at the islands in the Cattegat, it is now carried on everywhere, where there are plaice in this sea, and where the condition of the bottom (stones or the like) does not prevent it. The places where the bottom does not permit this fishery, lie however like little islands only among those which are fit for use, and the fishermen know how to approach so near to these islands that every plaice which ventures outside the stone banks is very much exposed to being caught.

In our smaller seas, with the exception of the Limfjord, which is the real home of this seine, the plaice-seine has not thrived very well on account of the roughness of the bottom (stones and vegetation); but here again the plaice are not so common and valuable, and the areas are not so large, that the earlier fishing-gear (gill-nets) could not catch what was necessary; finally, many of these little seas do not contain, perhaps, a *stock* of plaice properly so called, independent of the Cattegat, so that the destruction in this sea, *perhaps,* has reacted on the other seas; the stock, however, has scarcely suffered so much here as in the Cattegat. (See ante p. 35—36.)

The earlier, shallow fishing-grounds in the Cattegat were first fished empty of large fish, then the fishery was removed to deeper and deeper water in search of such. When in this way the earlier fishing-grounds had been exempt from fishery for some time, half a year or a whole year, then it often occurred that it would pay again to fish here for a short time, till again there were only small fish left.

Now the fishery is carried on so that the fishermen find out the places where the largest and the greatest number of plaice are, *and there they fish them up in a few days.* The pursuit is then continued to other places, and if the fishing-cutters that carry on this fishery in the Cattegat had not learnt to go round the Skaw in the best season and look up the plaice on the western shore of Jutland in Skager Rack, the profit of the Cattegat-fishery would have been even poorer than it is now; by the removal of the fishery in the best months of the year to the western shore, the Cattegat is left a little in peace, and the plaice get time to grow. The large fishing-fleet, however, can very easily manage to keep the stock in the Cattegat down in such a way that the plaice never reach any considerable size, as they did 10—15 years ago. For when it appears after some absence from a certain fishing-ground that marketable fish have returned to it, the only explanation will generally be that the young fish now have grown so much that they can give a decent profit. Only in the neighbourhood of the Skaw (for instance at Herthas Flak) a larger emigration of plaice from the Skager Rack would not be quite out of the question, and this, after all, would scarcely occur to any very great extent*).

In this way the plaice is kept under a certain length, just as the grass is cut in summer-time and the single blades thus constantly kept under a certain length. Though of course there are some more individuals among the plaice that are able to avoid the »machine« than among the blades of grass, but in the main I do think that this representation of mine agrees very well with the facts in the Cattegat relative to the plaice, partly also with respect to the turbot, brill, and perhaps the sole.

It is a good thing, in a way, that we have come so far as to command the wealth of the sea in such a perfect manner; and the way of fishing: to take the larger fish and leave the little ones, is indeed so excellent that we cannot even manage a fishing-pond, which we drain in order to take the fish we wish, on better principles.

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*) Be it remembered that plaice in greater multitudes live only from the shore and out on a depth of c. 50 (70) fathoms. The Skager Rack and the Norwegian fjords belonging to this sea are therefore nearly destitute of plaice, with the exception of the shallow places situated near the north-western shores of Jutland.

But why then do we constantly speak of the destruction of our fishery, what is the cause of the great decrease we can point out in the supplies of good fish in our market, and of the growing dissatisfaction among the owners of fishing-vessels?

The answer is very simpel: because we — to use once more the picture of the grass — because we cut the grass a little too short, *we fish the plaice* 3, 6, *nay perhaps 12 months too early, before they have reached any considerable selling price.* —

When a man drains his carp-pond and takes all the carps, then the pond is empty; but nevertheless nobody will here speak of a destruction, if only the man takes care of two things:

1) to get the carps well paid,

2) to place young fish in the pond again.

In order to get a good price for the carps, they must be of a certain size and in good condition; this, however, is easily managed by the carp-breeder, as all the fish in such a pond generally are of the same age and therefore of about the same size. With the plaice it is somewhat different; they are fished in many sizes and generally not sorted by the fisherman in this way. Since the new law has come into force the quite small ones, certainly, are sorted from the others, but all fish over the size limit, 8 inches to the base of the caudal fin, are taken ashore, though *most of them have not reached the size by which they obtain the highest selling price per lb.*

In the years when there were many large fish the management of the fishery was based on these. At the Skaw, for instance, I have seen plaice-nets with meshes 7 inches wide, and they had been in use since 1880 on the north-side of the Skaw. But gradually as the large plaice were caught, it became necessary, in order to get a sufficient quantity, to base the fishery on smaller and smaller fish, and it is quite out of the question now to use plaice-nets, unless their meshes are under 5 inches. At the Skaw the fishermen think they have gone far in proposing meshes of $4^1/_2$ inches.

It is a matter of course, when the fishery, as it is here assumed, can be carried on too eagerly, that it is of great consequence with respect to the value of the aggregate profit, if the fish is taken when it is little or when it is a commodity which demands the full selling price per lb.; but we get farther away from the latter, the smaller the fish become which are taken ashore. Certainly, we have no statistics to prove that the fish in the Cattegat are now, on an average, much smaller than for instance 10 years ago, but nobody who has had anything to do with this fishery during these years, can doubt it. I have seen it myself, and remember distinctly what an impression it made on me when in 1883 I visited Frederikshavn for the first time, and saw the plaice there. What large fish I saw, compared to those which were then caught in our southern seas; and now it is sometimes vice versa. Every fish-monger in Frederikshavn who has dealt in plaice during these years will be able to confirm my words.

It will be clear from the above that we now get a *smaller profit in money* than before from the fisheries in the Cattegat, *east of* the Skaw, the fishing-grounds, consequently, which have suffered most; and though the statistics make no difference between the plaice which are fished in the Cattegat and the German Sea (the Skager Rack), when they are only fished by the boats which belong to the Cattegat, yet, in spite of the great development of the fishery, they show no considerable advance in the profit of late years. *The profit of the fishery of flat-fish, in as well as outside the Cattegat, from all the boats east of the Skaw*) was in*

1885 c.	985,070	Kroner.	1,024,741 score and 50,894 lbs.
1886 c.	809,791	—	823,525 score and 56,505 lbs.
1887 c.	962,797	—	913,161 score and 287,541 lbs.
1888 c.	1,026,925	—	692,635 score and 343,485 lbs.
1889 c.	1,391,069	—	822,915 score and 487,762 lbs.
1890 c.	1,390,568	—	886,503 score and 588,364 lbs.
1891 c.	1,303,816	—	757,760 score and 492,538 lbs.
1892 c.	1,449,335	—	871,139 score and 485,580 lbs.

That moreover a great number of fish under the authorized size limit are carried ashore may be concluded from the opposition which is always met with, whenever the question of forbidding it is discussed. These too little fish are so easy to catch that they may be taken in great numbers by any open boat from land. Fortunately there seems to be no want of them, and I consider myself entitled to say, that I suppose there is fished in the Cattegat as great a number of plaice yearly now as ever there was, nay perhaps more, but many of them are, I think, thrown out again. — In our enclosed seas, however, the matter is perhaps somewhat different.

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*) The table is based on the official reports by Lieutenant *C. J. Hansen*, R. N.

I think, therefore, we need not trouble ourselves with that part of the carp-breeder's task which consists in placing the tender fry in the drained pond; as far as we can see, nature itself takes care of that in the *Cattegat* and *Skager Rack;* but I think it has been quite overlooked that *if we fish the plaice while they are small, we do not get so great profit by them as we might and ought to have. — In this only, as far as I can see, the »destruction« consists.*

It is impossible to state with certainty how much the plaice which are now *fished* in the Cattegat, weigh on an average; for the are at the various seasons of the year, and at the various fishing-places, of a very different size. Somewhat easier is it to estimate the size of the plaice *which is sold at Frederikshavn.* According to the weekly reports in »Dansk Fiskeriforenings Medlemsblad« there are sold great quantities of fish between (8) 10—14 lbs., and there are sometimes on deeper water caught also large fish of c. 20 lbs. the score; this however, occurs but rarely, and only on a very limited area in the northmost or northeastern part of the Cattegat on 20—30 fths. In that part of the Cattegat where the fishery is usually carried on (for instance Læsø-Rende and Aalborg cove) the plaice never reaches such a size, and I do not think we are much mistaken in *estimating the average size of the plaice which are fished in the Cattegat and sold at this market, at c. 10—15 lbs the score;* deduction made of course of underzised fish*).

Mr. Th. Brønnum, fishmonger at Frederikshavn, has kindly informed me that the average wholesale price of plaice of the various sizes a few years ago was as follows:

For	fish	of	8—9	lbs.	the	score	the	average	price	was	c.	9,8	Øre	per lb.
-	—	-	10	-	-	—	-	—		-	-	10,5	-	- -
-	—	-	12	-	-	—	-	—		-	-	10,8	-	- -
-	—	-	14	-	-	—	-	—		-	-	12,5	-	- -
-	—	-	16	-	-	—	-	—		-	-	12,5	-	- -
-	—	-	18	-	-	—	-	—		-	-	13,1	-	- -
-	—	-	20	-	-	—	-	—		-	-	13,75	-	- -

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*) I do not speak here of »Frederikshavn-plaice« from Skager Rack and the German sea; they are generally much larger than the Cattegat-fish.

For fish of 25 lbs. the score the average price was c. 13,0 Øre per lb.
- — - 30 - - — - — - - 13,3 - - -
- — - 35 - - — - — - - 13,6 - - -
- — - 40 - - — - — - - 13,75 - - -

The plaice, consequently, reaches its greatest value per lb. with a weight of 20 lbs. the score; i. e. it is the best commodity when it has that size. If we take it for granted, as I have here stated, that the Cattegat *now* produces fish of c. 10—14 lbs. the score, we must by this production 1) lose 2—3 Øre per lb. fish sold, besides suffering a greater loss by the multitude of little fish which cannot be included in the calculation (the underzised fish); 2) lose the difference between that quantity of fish-meat which the Cattegat now produces and the quantity it would be able to produce, if the stock of fish were not »cut« so short as the case now is.

For it cannot well be doubted that the same area of sea would be able to give a quantitively greater profit as a constancy, when we suffered the stock of fish to be as fully developed, as in the years before the too eager fishing commenced, — and then took exactly *so much as the stock could reproduce by new growth.* — It is constantly presumed that this might easily be done in the Cattegat with the present fishing-fleet. —

Nay, can there be no doubt of it after all? — Might it not be possible that the Cattegat could produce a far greater number of plaice of 10 inches*) every year than for instance of 14, and even so many more that those of 10 inches weighed together more than those of 14?

That there are more plaice of c. 10 inches than of 14 inches in the Cattegat is a given thing, when all the seasons of the year are taken together, but that they together should weigh more than those of 14 inches is little probable; for a plaice of 10 inches weighs less than $^1/_2$ lb., and one of 14 generally more than the double; more than half of those plaice that are 10 inches long must consequently die before they reach the 14 inches, if not those that attain this length *taken together* should weigh more.

But we might also very well think, it will here be objected, that they die or are eaten by other fish or the like; for, after all, the plaice can reach only a certain size, and there were even in earlier times not very many in the Cattegat that were, for instance, 25 inches; so there must be a limit in its size, at which the plaice grows slowly and the mortality, therefore, is great with a given length.

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*) The measure is here taken to the tip of the tail, not to the base of the caudal fin.

I am sorry that we know but very little of the mortality of the plaice at its various ages; but it is in itself not very likely that it should be so very great at a time when the fish grows much (for instance when it is 10—14 inches), particularly as its maximum size in the Cattegat, as we know, is much greater (c. 25 inches).

Diseases we scarcely know to be among them, and if they suffered from any very extensively, this would certainly have been observed by man. We must rather think of other animals as the chief cause of the death of the larger plaice, viz. cod, sharks, rays, anglers *(Lophius piscatorius)*, halibuts, *Delphinidæ*, seals; and of these, I suppose, it is chiefly the cod and the marine mammalia on which we need fix our thought, for, of the rest, *Lophius* and the halibut have suffered much from the fishery in the Cattegat, and are not common any more, while our usual sharks and rays scarcely can take plaice of 10—14 inches in great numbers.

Now as to the cod, it is only the large codfish which may be supposed to swallow such larger plaice, and in a few cod I have also seen flatfishes, but never plaice, only common dabs. This might be accidental, as I have only examined a smaller number; but in Scotland much has been done to clear up this question.

In the Firth of Forth 727 cod were once examined, and in 50 % of them remainders of fish were found, viz. of whiting, launce, long rough dab, herring, *Agonus*, common dab, cod, haddock, and some indeterminable remainders besides a few rare fishes, In another year 131 cod were examined at the same place; in 53 % were found remainders of fish, among which could be distinguished remainders of launce, *Agonus*, *Lumpenus*, whiting, haddock, goby, herring, cod, gurnard, long rough dab, and common dab — but *remainders of the plaice are never mentioned as found in the stomach of the cod from the Firth of Forth though many plaice are living there;* nor have plaice been found there in any other fish's stomach — for instance in rays, *Lophius* — so it is scarcely probable that larger plaice, on the whole, are eaten by very many fishes.

How it is in this respect with the marine mammalia, porpoises, other dolphins, and the seals, I do not know for certain, all of them are great ichthyophagists, it is true, but I must suppose it is here »round« fishes that suffer most, particularly from the seals. It is well known that these follow the shoals of garfish and cod, but that any of the said marine mammalia particularly seek the plaice is a thing I never heard of; on the contrary, it is always other species of fish they have been accused of pursuing, and, I dare say deservedly.

I must therefore suppose that a very high per cent of the plaice in the Cattegat which now reach only 10 inches would reach 14 inches if they were drotected, and they would in that case produce a much greater quantity of meat every year.

It might be objected here that it would possibly be still more profitable to permit the plaice to reach 15 or 16, nay 20 inches before they were fished.

Yes, it is very possible — and here we arrive at the most difficult point of the whole matter, viz. the question: *which size will give the greatest profit on the stock?* We cannot answer this question *till we know exactly the growth and average mortality of the fish at every stage of its life* — and such exact knowledge we shall scarcely ever be able to get*). The only thing we can do, therefore, is to try to base the fishery on *larger fish* than those on which it is *now actually* based, and then go on in that way as long as it pays. It will scarcely be profitable to stop till we have got so far at least that the main quantity of the fish that are caught is so large that they obtain *the highest price per lb. which on the whole is paid for this species of fish,* i. e., c. 14 inches in length, or 4 inches longer than the present size.

As I have said, it is possible only through experience to find the size that gives the greatest profit, and we cannot say, for instance, that our object is only to get a stock of fish which is so richly represented by *large fish* as the sea in question is able to produce it; for if these large fish were 5 years old they would take much room up for those that are 4, 3, 2, and 1 year old, and which also ought to be permitted to grow up; and if the 5 years old fish were *too* numerous, the stock certainly would be valuable, but it could not continue every year to give the greatest profit. — Just think of a forest, for instance, consisting *almost exclusively* of large trees; it may represent the greatest value of wood which it is possible to find on the area; but if care is not taken to replace the large trees with smaller ones, *the forest can not continue every year to give its maximum profit.*

It is *possible* then that the grown-up fish can be too richly represented; yet, in practical life, as far as the fish in the sea are concerned, where the question is only of individuals 1—2—3—4—5 years old, I suppose we need not pay any regard to this, as we must with respect to the forest, with trees which are often 100 years old and which must have substitutes for all the 99 years; and particularly so, as the plaice of various annual series frequent various parts of the seas, and generally do not mingle with one another; therefore they will scarcely take up the room for one another to any very great extent. I have wanted only to mention this as a formal possibility, which cannot be passed over by the theoretical discussion of this whole matter. It would be otherwise perhaps, in seas where too much protection was to be feared, but it will scarcely be necessary to enter more closely into this side of the question.

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*) These matters are still more complicated, because we have various races of plaice which do not grow alike. In the eastern and northern parts of the Cattegat, however the question is, I dare say, chiefly of one race, and that a very large one.

This view of the cause of the decreasing flat-fishfisheries in our seas is here set forth for the first time with more thorough proofs; no one, as far as I know, has published opinions which quite agree with mine.

In Scotland has Dr. *Fulton* supposed that it would be sufficient if we took care that the fish were not caught till they had spawned *once*, as they would then have contributed to the continuation of the species; and *E. W. L. Holt*, in England, has also thought of augmenting the profit of the fishery by artificial *fecundation of the eggs,* perhaps in connection with *hatching* by artificial means. Also other ways have been proposed in order to improve the fishery (prohibitions against fishing that destroys the quite small flat-fish, regulations with regard to the width of the meshes, etc., into which I shall enter more closely in the next chapter), but it seems to me that this has been done almost always with the secret thought that it is the *propagation, the increase of the number of individuals* which is the principal thing in the whole question. *Cunningham,* however, has incidentally set forth the thought (in contradistinction to Dr. *Fulton*) that it is of greater moment that a fish is *grown-up* than just *sexually ripe*, particularly if it becomes ripe when young and with a small size; but he looks upon this as a thing impracticable on deep water as far as the trawl is concerned. (J. Mar. Biol. Ass. (N. S.) II, p. 116). It will be perceived that I lay the greatest stress on the growth of the single *individuals.* My theory might be called therefore the **growth-theory** in contradistinction to the other **propagation-theory.**

It has always been hard for me to believe that there should be any want of eggs of plaice in our seas, partly because *Hensen's* excellent investigations have shown what immense quantities there are of them, partly because I myself see our seas filled up with such eggs.

Nor have I ever been able to believe in any want of small plaice; our shores in the Cattegat teem with them, so that it is hard to imagine there could be any more individuals than there are. Nay, everything seems to me to indicate that it is not in the *beginning*, but in the *middle and the end of the life of the plaice,* that we must look for the injury; *for it is here that man interferes as a most troublesome factor.*

It must be granted, however, that things are somewhat different perhaps on the shores of Great Britain; and of course it is quite necessary that there are some fish which reach sexual maturity and are able to breed. But as to this there is no danger for our races of small plaice; the present size limit of $9^3/_4$ inches (8 to the base of the caudal-fin) protects even many spawning fishes. The object here is not to produce fish *which are ripe or spawning,* but fish of **sufficient** *size*, fish that are **sufficiently** *saleable.*

Both theories, the *propagation-theory* and the *growth-theory*, however, point towards the same *practical measures*, viz. protection of fish under a given length. We shall in the next chapter see how, *just in our seas, there can be well-founded hopes of beneficial results from such a protection.*

Résumé: When the plaice-fisheries have decreased so much in our seas of late years, we must look for the cause in the fact that the plaice are generally fished before they reach their full value per lb. in commerce — before they are *sufficiently* saleable.

Chapter III.

How can we add to the yearly profit of our flat-fish fisheries east of the Skaw?

By preventing abuses of the single individuals of the valuable species of flat-fish under given sizes (lengths).

When we speak of prohibiting the landing or selling of fish under a size limit in order to protect the stock of fish, the first question will be: Is it really practicable to cut the stock of fish after such a fixed line? Are we not obliged simply to take what we get in the fishing-gear?

I shall here look at the question apart from the difficulties which might perhaps arise from the international character of the greater part of the Cattegat, and regard it from a Danish point of view only.

The plaice-fishery east of the Skaw is for the greater part carried on as a special fishery, i. e. with fishing-gear especially constructed for it, either *seines* or *gill-nets* the size of whose meshes is *intended for plaice.* At the same time other fishes are also accidentally caught in this fishing-gear, viz. the other flat-fishes, cod, lump-sucker, etc.

Plaice are caught, however, in other ways too, particularly in our smaller seas, viz. with *hooks, especially adapted for plaice* and baited with worms *(Arenicola)*, for instance in the *Lesser Belt.* These are the sorts of fishing-tackle *particularly used for plaice-fishery,* which are of any greater import.

The plaice is caught, moreover, in fishing-gear, not particularly adapted for it, for instance *sole-seines* (the Cattegat), *haddock-seines* (the Skaw—Aalbæk), (ground-seines), *eel-handseines* (the Limfjord), to a very slight degree also *eel-trawl seines* and several other sorts of *seines* (herring-seines, deep-seines ammodytes-seines etc.), finally also in *weels*, mostly *cod-weels* and *pound nets* — and perhaps, in smaller numbers, in *sole*-nets, *cod*-nets, and *haddock*-nets. — That plaice may also sometimes swallow *the hooks intended for other fishes* is a matter of course; this, however, happens only to a small extent.

The object of almost all plaice-fishery in our seas is *to catch the fish alive and to keep them alive* in pond or cauf. In this we succeed pretty well with respect to all *seine-fishery* in *pond-vessels,* so that it is a rare thing to get dead plaice in the seine. Personally I never saw it, and I doubt whether it will ever happen under normal conditions; but I have heard it mentioned that the seine may be hauled in so quickly with a steam-winch that the fish may be hurt. Such a thing, however, nobody will do more than once, I think, as the fishery in that case is quite in vain.

It is generally very easy for the plaice-seine fishermen in the large vessels to catch the fish alive, and it is still easier in the small ones where the hauls are shorter and the quantity of fish in the seine smaller.

What is said here of the seines (plaice-seines), particularly adapted for plaice-fishery, will hold good generally with respect to the other seines too, which happen to catch plaice, such as *sole-seines, eel-handseines,* and *eel-trawl-seines.* As to the *haddock-seine* or the *ground-seine*, as it is used at the Skaw and Aalbæk (and at a few other places), matters are a *little* different. The plaice, to be sure, are fished alive in it, but as the seine is generally used in the night, in darkness, and the whole take is hauled ashore on and in the sand, the take certainly might live, if it were thrown out again soon, but *it is not intended to be kept alive* as the fishermen have not, and cannot have caufs lying in the water at the Skaw. After all, it is the case also with the fishery carried on with little jolly-boats from the Skaw and Aalbæk and all harbourless open shores that the take is not *intended* to be kept alive; but also in these cases we must take it for granted that *the vitality of the plaice, when they are caught, is quite unimpaired.*

This it not the case with every species of fish. I need only mention such as garfish, whitings, herrings, etc., even when they are caught in *seine;* but the plaice is *very tenacious of life,* and can bear living out of water for a long time without suffering any harm from it. I shall in this connection only mention that I have had plaice sent to me in a dry box by rail from Struer, which on arrival at Copenhagen were quite capable of living, and that the fishmongers in Frederikshavn make use of this tenacity of life to send the plaice *living to Christiania per steamship in dry boxes.* The fish must during the passage lie in single layers, for which reason the boxes have many floors.

When these fish after many hours of steam navigation arrive at Christiania they are put into salt water and live there, nearly all of them, till they find buyers.

But now the other ways of plaice-fishery: *gill-nets* and *hooks?* Well, also with such fishing-tackle a fishery is carried on, based on living fish, and here too, consequently, the fish are caught alive. There are exceptions however from both.

When, for instance, in bad weather the nets cannot be brought ashore for several days some of the plaice, or all of them, may die in the nets. This case is not by far the rule, on the contrary rather a rare exception, so that we may here say that the fish, when they are caught, are generally able to live, though not in so good condition as in the seines. If this were not so, net-fishery based on living fish, as it is carried on at many places, would be quite unimaginable.

But now the hooks, they do hurt the fish, certainly, and many must die. — No, after all, not so many as we might expect. As a rule those only die that have got the hook far down by swallowing it. By cautious treatment the others will be able to live, when the hook is removed, and *also on this fishery a take of living plaice is based;* but the mortality is no doubt somewhat greater than by the net-fishery. The numbers of plaice, however, which are caught on hooks, are as nothing compared to those that are caught in other ways.

Of the other sorts of fishing-gear which I have not yet mentioned more closely, and which *may happen* to catch plaice, viz. *pound-nets* and *weels*, I shall say only, that the fish here has, if possible, still greater vital power than if it were caught in seines, so that, on the whole, it may be said *that the plaice in all the ways in which it is* **generally** *caught east of the Skaw, is alive and capable of being kept alive in the moment it is caught, and that this is proved by the fishery itself — by the way it is carried on, and the way in which the fish are sold: both being based, in the main, on living plaice,* and might be based on these everywhere if wanted; the fishery with hooks, which is but of little consequence, being the only one likely to cause any difficulties.

By the fisheries which I have here mentioned more closely with reference to the plaice, the latter are fished in such sizes that they are generally fit for human food, even though they are often very small. The people in the northern and western Jutland are not very particular in such matters.

I shall now mention two other fisheries which have been briefly mentioned above, but want a closer examination: the fishery with *ammodytes-seines* in the northmost Cattegat, particularly at the Skaw, and with *eel-handseines* in the western Limfjord. By these such small plaice are generally caught that they cannot be used as human food, but at best may be thrown before the swine; in other words: they are *not saleable.* Table V will show what quantities of such little unsaleable plaice there are caught with the said fishing-gear. Column 6, table V, for instance, shows the take in 8 hauls with eel-handseines by *Jegindtap.* If we consider the plaice unsaleable with a length of ca. 7 inches to the tip of the caudal fin, more than 500 unsaleable fish were caught in these 8 hauls. Every year many thousands of hauls are made in the Limfjord with eel-handseines, so the question is of a very considerable number of *caught* unsaleable plaice. These multitudes of little fish are caught alive, and might easily be thrown out again in a condition in which they are fit to live; how far this is done, I do not know. The whole plaice-fishery with eel-handseines in the Limfjord has been called forth by the prohibition against all use of plaice-seines during the summer months. —

Table V, column 10, shows the contents of a haul with *ammodytes-seine* made by fishermen at the Skaw in order to catch sand-eels as bait for their hooks; a little more than 100 unsaleable plaice were caught by it, and many hundreds of hauls are made at the Skaw every year, while also the other small-meshed seines take unsaleable plaice there (for instance the deep-seine). Also these fish might be thrown into the sea while they are still capable of living, if the fishermen would take the trouble; but I do not think they generally do so. These abuses however scarcely amount to such quantities as in the Limfjord. With respect to this fjord I see no better means of avoiding these abuses than a prohibition against the landing of plaice under an official size limit, and perhaps permission to use plaice-seines in the summer. At the Skaw and other places where ammodytes-seines are employed, it will be difficult to forbid the use of them; but it might be made compulsory on the fishermen, I think, as soon as possible to throw the small plaice into the sea again. At any rate we must keep an eye upon this fishery, and prevent it from spreading too much at places where the young plaice live in great numbers, such as the case is at the Skaw and in the cove at Aalbæk. —

In England they have a way of fishing *Crangon vulgaris* by means of *shrimp-trawl,* which to a very high degree hurts the little flat-fishes, which seek just the same places as the shrimp, viz. the clean sand deposits on shallow water. Prohibitions against this fishery plays a great part in the propositions set forth by scientific men in England to promote the flat-fish fishery, and, certainly, justly so.

In our seas this fishery is not known, so to speak, at any rate not in the same form. *Ammodytes-seines* and *eel-handseines* in the western parts of the Limfjord are those of our fisheries which get nearest to the English shrimp-trawl with regard to the great quantities they take of unsaleable flat-fishes. A few other sorts of fishing-tackle for bait, as »Ulken« in the Sound, are perhaps not quite innocent neither; but with the exception of the Limfjord I do not think much will be won for the plaice by prohibitions against these, and much will be lost in other directions. —

In order to promote the plaice-fishery, *in our seas* at any rate, it is not enough to protect the *unsaleable* fish only; we must also, and particularly, protect the *saleable* fish so that the latter becomes **sufficiently** *saleable*. I am convinced that no other way will lead us to the goal: the greatest possible profit. —

When we want to protect the plaice in our seas, it may be done in two ways: 1) we might demand a *certain minimum size of the meshes* in all sorts of fishing-gear employed in plaice fishery; 2) we might make it compulsory on the fishermen to throw all plaice that were caught *under a certain size* into the sea, permitting them on the other hand to fish with meshes of whichever size they wanted. (Regulation as to fishes *under a certain official size limit.)*

The former method would meet many, as a rule *insurmountable,* practical difficulties; the latter would meet some, I believe surmountable hindrances. I shall enter somewhat closer into this question.

Let us imagine that a mesh of 6 inches, i. e. one whose 4 sides were each 3 inches long, in plaice-seines would be suitable for the protection of the plaice we wanted to protect, then the difficulty would immediately occur that the fishermen scarcely would or could live by fishing plaice with such a seine in the first six or twelve months, or perhaps only in a few months; they would then take a *sole-seine* with such small meshes as they thought fit, and fish plaice — and perhaps a few soles — with that.

If we would try to prevent such an evasion of the law by forbidding, for instance, the use of the sole-seine except in certain months of the year, we should either be obliged to extend these months over a great part of the year, or run the risk of losing a great part of the solefishery. And then — even if we did do it, the result would be just the same: the fishermen might then take seines with meshes of 3 inches, as the haddock-seines, and say: now we are fishing for haddock and cod — and get plaice.

That is the way at present in the Limfjord where they must not fish with plaice-seines in summer, but in stead of that use *eel-seines* to catch the plaice — and so get many more little plaice than they would otherwise do.

Indeed, the only thing we could do was to say: *plaice, not fished in plaice-seines, must be thrown into the sea, whether they are large or small, whether they are dead or alive.* The fishermen would then *perhaps* do what they could in order not to catch soles and plaice at the same time; but we had then also got a Draconic regulation which in no way could be controlled and, consequently, would not be followed; — **and which would be useful only if the fish that were thrown into the sea could live.**

As we have here supposed the result to be with the *seines*, it would be also with the *nets;* for we have all sizes of meshes, from *haddock-nets* and *cod-nets with small meshes* to *nets for large plaice* and *turbot.*

And what was to be done with all the little plaice which accidentally were caught in *pound-nets, cod-weels,* etc.! Only one thing: to throw them into the sea again. — This whole system of a fixed size of the meshes would, in a country with so complicated fishing-methods as ours, be at variance with nearly all fishery-interests, *if it were carried through so that it really did help to protect the stock of fish.*

That this could be done in any way, I do not think; much control would be necessary, and *even if all fish* which were caught in other sorts of fishing-gear than those intended for them, *were thrown out, it would be of any help only* **if these fish could live.**

A regulation as to the size of the meshes can be carried through only in seas where very few sorts of fishing-tackle are employed, for instance in the German Sea with respect to the English trawl; but as the latter after all must be able to catch many sorts of fish, the size of the meshes must be fitted for the *smaller* sorts of soles, and will then be of no value for the plaice.

Here is not yet mentioned the great difficulty in carrying out such regulations practically; the matter is that *the meshes change their size* when they become moist, when the fishing-gear grows older, and when, for the better keeping of it, it is boiled or tarred with the stuff necessary for this proceeding, *so that a fishing-apparatus which to-day is legal, to-morrow perhaps is illegal.* This gives much trouble to the officers who have to control them, and is the cause of great expense on the part of the fishermen.

That this circumstance in itself is a very heavy complaint against regulations as to the size of the meshes is evident from the great number of fishing-apparatus which are condemned in the Limfjord when they become older, because their meshes have shrunk too much.

It is thus *in general* quite impossible by law to take care that the various species of fish are caught with the meshes that are most suitable to them, but there are nevertheless certain exceptions where regulations of this kind *may* have some value, viz. where a minimum size of meshes which, according to the local conditions, may really to some degree protect the fish can be fixed for *all fishing-gear of certain classes, for instance for seines or weels.* In seas where the income of the fishery is greatly dependent on *the eel*, as in nearly all our smaller seas, a size of the meshes like that which we have in the Limfjord for the *eel-seines* can really protect the eel under a certain size, as it can be enjoined that no **seines** with smaller meshes that those which are fixed for eel-seines may be employed in the said seas; for this is a regulation which can be controlled.

When we have gone futher and have tried to fix the size of the meshes in seines intended for the larger fishes, for instance the plaice, then it seems to me that we have gone too far. Moreover the use of plaice-seines has been forbidden during certain months, and the result has been that the fishermen use eel-seines for the catching of plaice during the time when the plaice-seines are forbidden. The latter cannot easily be forbidden, from the above mentioned reasons, when we are not sure that the fish caught in these seines can be thrown into the water again in a state in which they are capable of living.

Another case in which we might think it practicable to fix the size of the meshes is to be found at a place as Sæby, where *at present* the fishery is only carried on with very few sorts of fishing-gear, scarcely any but plaice-nets with so large meshes that they can only fish large soles and suitable plaice.

Under such circumstances a fixed size of the meshes could be useful; but if the fishermen afterwards took into their heads to fish for haddock or cod — or if this became necessary — then it would also at such a place be unjustifiable to forbid nets suitable for these fish; and if the use of such nets with smaller meshes were permitted then the regulations with respect to the larger ones would be quite illusory; for haddoc-nets can very well fish plaice and other flat-fishes, as with the exception of the size of their meshes they are of about the same construction as the plaice-nets. Here again then an *effective* protection by means of the size of the meshes could only be carried out, when it was enjoined that all plaice caught in haddock-nets, etc. were to be thrown into the sea again. In other words: *when we except the eel, the thinnest species of fish we have, regulations as to the size of the meshes will be of no avail for the protection of the fish, if they are not supported by the regulation that larger species of fish which are caught in fishing-gear with little meshes intended for other fish, are to be thrown into the sea again.*

This would require a strict control daily with the fishery which is carried on by every single fisherman, *and would, after all, only be of any avail, if the fish that were thrown out could live.*

We might set forth an objection to this, however, particularly with respect to the conditions of the Limfjord: Even though the fishermen in this fjord, in summer when the plaice-seines are forbidden, are permitted to fish with eel-seines, these will generally be unfit for the catching of plaice; they must be subject to a few changes; not with regard to the size of the meshes, but the lines belonging to the seine ought to be somewhat longer, the weight below perhaps somewhat heavier, and the floats above rather fewer in number, finally the net itself had better be carried (dan: ført) to the lines a little more stretched out, so that the meshes stand more stretched out, <>, than if they were exclusively intended for eel-fishery.

There is no doubt that the takes of flat-fish would be somewhat reduced by detailled regulations with regard to these things; but it could not be quite prevented, and it is very difficult to enter into such regulations in a law, as it will oftenest be a matter of opinion on which the question hinges, the eel-seines proper being not »ført« exactly in the same way when used on different bottoms; moreover, we might easily prevent the clever fisherman in his work by entering into such details of practical fishery, and hinder him from improving the construction of his fishing-gear, *and here a constant development is going on, accompanied by constant experiments* which it would be very wrong to prevent.

Finally, it could not be expected that the takes of small plaice would be quite prevented in this way; it would only be somewhat diminished, and it is my opinion that we had better think twice before entering into things that will involve so many incalculable consequences — particularly so, as it seems to me that we can arrange the whole matter in a far easier and more reliable way, only be means of regulations for the landing of little fish, regulations which can be applied to those species of fish of which we are more especially speaking here and have mentioned before, viz. the more or less stationary fishes on our shores, such as eels and flat-fishes.

I have paid no regard here to such species of fish as herring, garfish, mackerel, cod, whiting, and haddock, partly because they do not belong to this whole series of investigations, partly because they are so biologically different from the flat-fishes that the pursuit of them must be regulated in an essentially different way — if on the whole it is necessary to pay any regard to these species as far as protection goes.

The principal scruple by fixing a suitable size limit for plaice has always been, whether the fish can really live after they have first been caught. I now mean to have proved that we need have no very great fear of that, and — as I have shown too — we do not solve the question by regulating the size of the meshes; for if the regulations are to be of any help, it will generally be necessary to further support them by prohibitions against the use of fish under a size limit.

With regard to the other flat-fishes this question of meshes is somewhat different from what it is with regard to the plaice; with the exception of the *sole* we can scarcely speak of any special fishing-gear with which to catch them, i. e. they are taken in all sorts of nets intended for plaice, and the result of this will be that the species of fish which are smaller than the size limit for the plaice will not be caught, and that those which are larger will be caught too small.

The latter result will be a hard blow to the most valuable of them all: *the Turbot* and *the Brill.* — A smaller size of the meshes might be fixed for the *sole,* but then soles only and the smaller flat-fishes should be caught with this, while the larger ones were to be thrown away when caught.

It is proved thus, I think, that we cannot as a rule protect the various species of flat-fishes under a certain length fixed for each species, by regulating the size of the meshes only, especially if the regulations must be conformable to the average size of the species in our various seas; but it must be supposed that we shall generally be able to obtain the wished for result in another way: **by prohibitions against the landing or sale** of such species of fish, under the size fixed for each of them, as are generally able to live after they have been caught.

We may forbid by law to *catch* undersized fish, but they will always be caught notwithstanding, in smaller or greater numbers, as long as it is permitted to fish the small species of fish, whether we regulate the meshes or not; but when the fishermen throw out again the undersized fish of such species as are able to live afterwards, these species would not suffer any very great harm.

Among the species particularly tenacious of life are fortunately our more valuable fishes, and this is not accidental; for from that very reason that their skin, and the scales fixed in it, is so strong and not so easily destroyed, these fish are tenacious of life, and *from the same reason they are fit for sale;* for their appearance does not suffer too much by the various transportations to which every fish, as a rule, is exposed before it is eaten. Moreover this tenacity of life permits the fishmonger to keep the fish alive in tanks for a long time without diminishing the value of the flesh, while the price is perhaps rising considerably.

As living fish are a necessity for Denmark, and particularly for Copenhagen, a considerable part of our trade and fishery is based on keeping such fish alive as can be kept so. This system can be carried through only where the principal market is situated directly by the sea, and this is the case only with few great fish-markets.

This system may have its weak points, but it has surely been one of the principal reasons why most of our fishing-apparatus, in contradistinction for instance to the English steam-trawls, are constructed with the view of catching the fish as unhurt as possible — and this again is a great help in carrying through the regulations for the protection of fish under the size limit.

If, therefore, instead of regulations as to the meshes in the fishing-gear for flat-fishes, we got prohibitions against the selling or landing of flat-fishes under the sizes suitable *for each species,* we should with respect to the plaice get exactly what we aimed at by fixing the size of the meshes, but we might *in addition to that obtain the same thing with respect to the other species* which are tenacious of life, for instance *The Turbot and The Brill etc.;* and we need have no control with the fishing-gear and the fishery on the sea, as a rule, a close inspection of the fish at the markets being the principal thing.

The only thing of which we must here be sure is that the little fish as a rule, can live when they are thrown out again, after they have been caught in the fishing-gear commonly used. This, it will be remembered, was also a necessary condition, if on the whole we would think of effectively carrying through the regulations as to the size of the meshes; this condition then we can in no way avoid. I shall try, therefore, to elucidate it as clearly as I can.

As I have said already, nearly all flat-fish individuals are by the various fishing methods caught *alive;* alive they are laid on the deck of the large vessels or on the bottom of the smaller open boats. If now a greater number of too small fish are seen in the take, is it possible then to have them thrown out before they suffer too much, i. e. before they become incapable of living?

Let us look first at the method which gives the greatest take: the *cutter-fishery* with *plaice-seine* in the Cattegat.

When the seine has been heaved home, the contents of it are lifted up on the deck, and the take spread over the same; 10—20—100 scores of flat-fish — or more — may be in such a haul. Now the sorting commences. All the large plaice are to be placed in the pond, and if there are any *Turbots* or other valuable fish among them they must be placed apart also; what is left is a greater or smaller number of fish under the size limit which consequently must be thrown overboard.

How is the condition of these fish after the sorting? Two moments are here of some importance: 1) how long time does the sorting last? 2) at which season does it occur?

Such a sorting need not last more than half an hour or three quarters, and, as a rule, it lasts only some few minutes when the men are expert. Within such lengths of time the plaice will easily preserve their vitality, provided the sorting is not undertaken on the very hot days, of which however we have but a few, generally in July and August, but which scarcely occur every year; on such very hot days with bright sunshine the plaice will *soon* be exhausted by lying on the deck.

I have made some experiments with flat-fishes, to see how long they can endure lying on the deck without dying. In the month of March 1892 a number of little plaice and common dabs were fished onboard the »Hauch«. They were laid on the deck in the sunshine, and while the little plaice (2—4 inches) could live for several (up till 4) hours, the little dabs died very quickly. — In the end of May a number (270) of little plaice (3—5 inches) were laid on the deck onboard the »Havørn«. They lay in 25 minutes after which time they were placed in salt water and proved to be alive all of them. There is no doubt that on very hot days the time in which the fish can bear lying on a warm, *dry* deck in the burning sun is somewhat diminished; but as the fishermen have nothing to do with such small fish as those, rather with fish of 8—10 inches, or even larger, and these are still more tenacious of life than the little ones, as moreover the fish pursued by the fishermen, *as a fact, nearly always are placed alive in the pond,* there can be no doubt that it is possible also to throw out the undersized fish after the sorting in a state in which they are capable of continuing life. *Perhaps* it will be hard to get sufficient time for the sorting on the very warmest days, but a little care on the part of the fishermen (wetting the deck, for instance, or putting up a little awning, etc.) will also here surely, as a rule, help them through the difficulties.

But it cannot be denied that on a few occasions some of the small fish will die, especially because the fishermen take so little care of them, when, for instance, they do not sort the fish as quickly as possible, when they tramp about among them, etc.; but it is my conviction that *with very few exceptions it is possible in the large cutters to throw, so to speak, all the* **plaice** *under the size limit out again in a state in which they are able to live*[*]*).*

The same can be said of the *soles*, which into the bargain are generally fished in the night and in the colder season, and moreover are *even more tenacious of life than the plaice,* according to the fishermen's statements and according to what I have seen myself during the fishing. That they cannot live in a tank as well as the plaice is owing to the peculiarity in them that they attach themselves to the ship by »sucking«, but this has nothing to do with their vitality while lying on the deck.

The turbot and brill have, besides their great tenacity of life, the advantage that they are caught in small numbers only by each haul, and therefore quickly can be thrown out again.

Among the other flat-fishes protected by law *the flounder* must be reckoned among the fish that are tenacious of life, while *the common dab* is rather delicate, loses its scales comparatively easily, and is not by far capable of living so well as the other above-mentioned flat-fishes.

As to *Pleur. microcephalus* and *cynoglossus* it might not be quite out of the question to protect at least the former in the way here mentioned, but as *small* specimens of the said species are but rarely caught, this would be without any practical importance; moreover they represent so small sums of money that it is scarcely worth the while for their sake to multiply the provisions of a law; for it must, evidently, be looked upon as a great advantage when a law of fishery is as »simple« as possible. As an example to show how long time it takes before such a law becomes practically used, I shall mention that one of the greatest fishmongers at Frederikshavn, when the present law had been in force for three years, was much astonished to learn that a size-limit had been fixed also for the turbot. He had at any rate dealt in turbots through these three years without knowing this regulation.

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[*]) It must be mentioned, however, that when there are caught many star-fish in the seine together with the plaice, then the latter may be hurt by touching these animals, so that their vitality is somewhat diminished; but if they are thrown quickly into the water, they will, certainly, as a rule recover their strength.

I do not think therefore that we ought to burden a law with regulations concerning more species than just necessary; for laws whose regulations are not kept actually in force by means of a very effective control and great care, are, I believe, only injurious.

From the above-mentioned reasons I think that a future law with respect to the flat-fishes ought to contain regulations *for the whole country* only concerning:

The plaice,
The sole,
The turbot,
The brill*).

On the other hand it would be good perhaps, if local regulations could take the *flounder* into consideration, a fish which is of no value for the export, but nevertheless at certain places is of some moment.

More difficult it would be to defend the said protection of the *common dab* in the Cattegat, partly on account of its unimportance to the wholesale trade, partly on account of its slight vitality, and moreover because it seems to propagate in the Cattegat at the expense of the plaice; at any rate it is astonishing to see the number of common dabs we get in *a seine with little meshes* almost everywhere in the Cattegat. Their number is certainly many times greater than that of the plaice, and as both fish live, partly, of the same food, it is not impossible that they are actually competing species, so that the common dab will spread farther at the expense of the plaice, when it gets the opportunity, as it now does, when the stock of plaice has been so much reduced by man. I do not know whether the common dab has always been so much more numerous than the plaice in the Cattegat, as it is now; but it does not seem likely to me, and we must be entitled to expect that, when we diminish the number of plaice without diminishing that of the common dab to the same extent, the latter will get the upper hand, and perhaps be able to prevent a new development of the stock of plaice. The number of common dabs carried into harbour in the Cattegat is as nothing compared to the number of plaice, not because they have not been fished frequently, but because they have been thrown out as valueless to the export-trade. Now it cannot be said here that, when we have fished them in such great quantities and they die so easily, as above stated, then they must have suffered so much already by the plaice-fishery that it is quite out of the question that they should have become more numerous than they were originally; — for let it be remembered: although the common dabs have been killed in thousands, and thrown out dead from the cutters into the Cattegat, yet those spots have been avoided where the common dab *particularly* goes, because the plaice oftenest are but in small numbers there, and the size of the meshes which diminishes the stock of plaice so much as it has been done, is unable to destroy the stock of common dabs to the same degree, as its individuals on an average are much smaller than the grown-up plaice. The plaice-seines must be supposed therefore particularly to have made havoc among the *exceptionally* large common dabs, and it its striking also how very few really large specimens we have found in the Cattegat during these explorations. Compare for instance table XI with table I from Fænø (»Report« III). It is evident that they oftener reach a higher maximum size at the latter place than in the Cattegat. This evidently cannot be the case originally with a species which is so decided a sea fish as the common dab; but I must suppose the reason is that the seine-fishery in the Cattegat has killed the big ones, while this is not the case in the Lesser Belt where there has been no seine-fishery of flat-fish carried on till 1891.

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*) There might be some reason also to propose a size limit for the halibut, but this fish is at present so rarely met with in the Cattegat (see *ante* p. 39), that I have been unable personally to study its biology, and I dare not, therefore, set forth any decided opinion on this matter. A size limit for this fish must, I think, as it has been proposed in England, not be smaller than c. 36 Engl. inches — the fish is not supposed to be mature till it reaches this length.

Consequently, though the large common dabs in the Cattegat have suffered much from the seine-fishery, the stock has presumably become richer and richer in little individuals and is perhaps managed in such a way that it gives the greatest bulk in pounds; but as this flesh has generally no value, it is scarcely any good to protect this fish by special regulations in the Cattegat, because it competes with the more valuable plaice. At mere local markets in our little seas, on the other hand, it might be defended, perhaps, also to protect this fish as well as the flounder.

Such as I have here represented the throwing out of the fish under the size limit with reference to the cutters, it will be also, pretty nearly, with respect to the fishery with seines and nets *in smaller boats*, with that difference, however, that the quick sorting will be so much the easier, the smaller the take is; and the take in the smaller boats is of course generally smaller than in the larger boats. On the other hand there is also the drawback, if the small boats during the fishing are caught in a storm, that *there will be no time at all for the sorting* till the boat has come ashore, and then, generally, all the fish will be dead. The latter misfortune will oftener occur to boats fishing with nets, than to those fishing with seines; for with nets the picking out of the fish takes a very long time, and it will often be necessary to go out fishing in worse weather than with seines; for when the nets *are* out, they must be saved at any price, if possible, as the fish would suffer too much by remaining for several days in them; at last they will die and be eaten by snails, star-fish, and other animals. The mortality among the fish taken by net-fishery is certainly somewhat greater than by seines; but according to my experience it is nowhere so great that it would not profit the fishery considerably if the flat-fish under the size limit were thrown out again when caught alive. —

Turbots, brills, and *soles* are very rarely caught on *hooks*, as these are generally used with us in the Cattegat, and the number of plaice which are hooked in the whole country are of very little moment compared to the whole fishery.

The flat-fish which are caught more accidentally in other sorts of fishing-gear, intended for other species of fishes, may, no doubt, be thrown into the sea again alive nearly without any exception. —

That our fisheries, particularly the great sea-going ones, are based on the catching of living fish, is a great advantage to us in the carrying out of regulations concerning fish under a size limit, as already mentioned above. — To judge from their statements in literature the *Englishmen* are situated far more unfortunately, *as their great fisheries are based on fish packed in ice,* consequently on *dead fish;* and by fishing with their big *trawl*, which as a rule is kept out for several hours at a time, so that the fish caught in it are dragged quickly along the bottom for a long time, the mortality among the fish is very great.

The English have seen already that the manner in which the trawl is used with us at Esbjerg, as also by the Germans there, is far more favourable to the vitality of the fish. *Holt* writes on this question in »J. Mar. Biol. Ass. II« p. 390—391: »I understand that from the manner in which the trawl is handled by German and Danish boats no injury is done to the unmarketable fish . . .« The principal reason of this is that they do not keep the trawl out as long as the Englishmen. It is scarcely necessary to repeat that our plaice-seines injure the fish still less than these trawls.

Résumé: It can in no way be prevented that a greater or smaller number are caught of *plaice, soles, turbots,* and *brills,* under the size limit, nor can it be prevented that a smaller percentage of them die, before they can be thrown out again; but if the fishermen throw out the living fish under the size limit, the stock of fish will presumably be protected in a good and satisfactory manner.

But now *the dead fish under the size limit,* of which sometimes a number must be left — by being thrown out they will, as a rule, only serve as food for the lower animals, and therefore, in part, be wasted if they are thrown into the sea.

To avoid this we might say: it is forbidden *to sell fish under* a size limit as far as the above 4 species are concerned, and all living fish under this size must be thrown overboard as soon as possible; the dead ones may be used by the fishermen as food for *themselves* onboard and on shore — a regulation, consequently, like that which is now in force with respect to a great number of species of fish.

It has *as yet* proved practically impossible to keep up this regulation at places where there are a great number of these small plaice, for instance at the Skaw and in the Limfjord, and it has been proposed to further sharpen this regulation so that any *landing* whatsoever of fish under the size limit would be punishable. In this way many dead small fish would be lost to man, and particularly many of the more delicate species; the regulation could be defended only on behalf of the species, which are in the highest degree tenacious of life for instance the 4 above-mentioned ones. Also of these, particularly of the plaice, some would be wasted, *if the law were really carried into effect*, and all dragging ashore of seines would then be impossible. The only thing won by sharpening the regulation in this way would be a somewhat easier control.

I do not doubt that it might be carried through to the benefit of our fishery with respect to the 4 above-mentioned species, and, of our other fish, among others also with respect to the *eel:* but whether, everything well considered, it would really be more profitable than the present prohibition against sale, when both *were looked to by the police* with that attention which both prohibitions necessarily require, is more than I can tell. It seems quite likely to me that it would be possible by the present prohibition against sale to prevent *greater abuses* of valuable fish under the size limit — and that is *the main point* after all. —

The most difficult part of the whole problem, both with respect to its theoretical and its practical side, is now remaining: *which size limit* ought then to be fixed for the four species, and are they to be varied in the different parts of the country? —

With respect to the *plaice* it must be said that the present size limit, 8 inches to the base of the caudal fin ($9^3/_4$ to the tip of the caudal fin), is very suitable when only one size is to be fixed for the whole country; but there is no doubt that it would be better for the sake of local interests, if it were possible to have three different sizes, 1) of 7—8 inches to the base of the caudal fin, in the Baltic Sea south of a line Copenhagen—Gjedser, 2) of c. 8—9 inches, south of the isle of Hjelmen—Sjællandsodde, and 3) of 10—12 inches for the Cattegat: all measurements taken to the base of the caudal fin, which in practice, when the caudal fin is shrinking, is a particularly good point to measure to*). —

It must be said here, however, that it would be very bad for the fishermen, if the size limit of the smallest marketable plaice in the Cattegat was suddenly fixed at 12 inches instead of 8; nay, even 11 and 10 inches would present difficulties. Some months or half years would pass before the whole stock grew so much, and in that time but little could be caught. Afterwards, to be sure, it would be so much the better, but as it cannot be said with certainty, at any rate not at present how long this growing-time would last, it seems more reasonable to make this change by degrees, from 8—9—10—11—12 inches, with an interval of one year between each step. We should then also get the opportunity, perhaps, of seeing, partly by trying to protect the plaice in the Limfjord, partly by following the development of the whole fishery in the Cattegat, whether it was improving and whether we had not better perhaps go on beyond the 12 inches; *for only experience can give answer to this question.*

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*) *Measures of length to the base of the caudal fin* are very practical: and if it were required by law that all flat-fishes which are dried were to keep their heads on, the control would be much easier. Particularly with dried fish there are going on many abuses of fish under the size limit. Regulations as to *weight* would here be practically useless; nay, by going in a cauf a fish migt become »illegal« in the course of a very short time.

I shall propose that we, in the mean time, in the Limfjord, of whose fishery the Danish nation is sole master, make experiments as to the protection of plaice, under a sharp control from land, the object of which experiments should be:

1) to give the plaice free entrance to the fjord by forbidding any fishery at places where the immigrating plaice might be caught in too great numbers; moreover, perhaps, such fish ought to be fished in the German Sea and sailed into the fjord in a fishing-smack with tank, as it has now been commenced;

2) to forbid in the Limfjord all landing of plaice under 10 inches to the base of the caudal fin in the first year, under 11 inches in the second year, etc.;

3) to follow closely in these years the course of the experiment and, by fishing, try to form an idea of how far we may go up in fixing the minimum size of marketable fish; for there is, among others, the possibility that the fish perhaps will emigrate from the fjord, if it grows too large, so that it must breed.

In other words, we should require a special law for the Limfjord as the place of these experiments. —

When it is so difficult to say for certain which size limit will be the most profitable, the reason of this is that it is not easy to know how large the *average size* of the plaice will be in the Cattegat, *when it is not, as now fished up too early;* for at present nearly all the large fish have disappeared, and the difference in length is, as shown in the table of ripe fish from the Cattegat, rather considerable, from c. $7^1/_2$—$21^1/_2$ inches; moreover our seas east of the Skaw evidently contain both large and small races, which grow rather differently and attain maturity with a different length. The small races are evidently favoured by our present way of working; for the large races are more exposed to being caught before they are able to breed, than the small ones.

In England where, during the discussion of this matter, it has been particularly emphasized that the fish must not be caught till they have spawned once, they would say that the average size of the spawners, when they spawn for the first time, according to the above-mentioned table is 12—13 inches (c. 10—11 inches to the base of the caudal fin), and as the milters are somewhat smaller, we must first take care of the spawners. They would say there: »The biological limit« for the Cattegat plaice is $12^1/_2$ inches to the tip of the caudal fin, and smaller fish must not be taken. —

In the German Sea has *E. W. L. Holt* fixed $12^1/_2$ inches as »the biological limit« for both sexes taken together, but $16^1/_2$ inches for the spawners.

Dr. Fulton in Scotland says that the smallest mature milters are c. $11^1/_2$ inches in the German Sea, and will fix the size limit accordingly. There is consequently a considerable difference in these authors' opinions on this matter, the reason of which is that one will base the size limit of all ripe fish on the milters, the other wants the spawners to be taken into consideration as well, and then again — are we to base the size limit on the smallest spawner we can find, or are we to take the average size? The object of the argument, as set forth in foreign literature, is, in a few words, to show that we must enable the fish *to spawn in greater multitudes than formerly* in order to augment their numbers, it being supposed that the fishery has prevented them from doing so; therefore the fish must be protected till it reaches maturity, or till it has spawned once.

As above mentioned, my view on the matter is somewhat different, viz.: There is no doubt that, owing to the fishing, there is not so rich or large a stock of fish as formerly; but *it is not the number of young fish which is too small.* What we have to do is *to prevent that the fish are taken so small (young) as they now are,* and therefore I want a minimum size to be fixed. I will not deny that it is possible to fish up a species of fish to such a degree that there are not left individuals enough for the breeding of them, but I believe that we are far from that point with the plaice. Were that really to happen, then of course it would be necessary to think of multiplying the fish.

Owing to our different views on what must be done in order to augment the productiveness of the plaice, my opinions on »artificial hatching« are also somewhat different from those of the Englishmen: I mean (nearly as the Germans) that it will get no influence at all on the plaice in the Cattegat if carried on in the usual way, i. e. without a subsequent rearing of the larvæ, while the Englishmen do not look upon this as quite impossible.

But whether now we hold one theory or the other: the *propagation theory* or the *growth theory,* the practical measures we have to take will be nearly the same, viz. the fixing of a size limit. For the Cattegat, according to the former theory, this would be c. $12^1/_2$ inches, or 11 to the base of the caudal fin, according to the latter probably still larger, but to begin with we might very well take a smaller size limit, as further developed above*).

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*) These two theories, however, will not give so identical results for all species of fishes; had we spoken of the eel *(Anguilla vulgaris)* for instance, a fish which is

One should think that the fishermen in the Cattegat would be glad to see such a regulation as the above-mentioned one with respect to a size limit for the plaice, and most of them I dare say will also be so. The fishermen however, who carry on a coast-fishery from open boats in the northern part of the Cattegat, from the Skaw and Aalbæk, will be sure to object to it. For there are, as above stated, almost exclusively young plaice in the seas near these shores, and even if they were more protected than they are now, these fishermen would scarcely get the opportunity of catching any larger fish, as the plaice removes from the shore the more it grows, and in this way gets outside the territory of the coast-fishermen. If in course of time the size limit of the smallest plaice is made much higher, these people therefore will be almost excluded from the plaice-fishery.

The coast-fishermen who live at the places where the young plaice lives will be sorry to see a severe protection. —

Larger places of that sort will, in the Cattegat, scarcely be found at any other fishing-grounds than in the cove of Aalbæk from the Skaw to Frederikshavn, though (compare *ante*) little plaice also live at Læssø and farther southwards along the eastern shores of Jutland; but of fishing-villages whose plaice-fishery is principally based on small (i. e. young) fish there are only Aalbæk and, in part, the Skaw.

By fixing a size limit, however, it was just the intention to prevent the catching of these little fish *wherever they were found* east of the Skaw. As they now principally live only at the above fishing-places, the whole regulation would lose its power, if such places were allowed to carry on their fishery for these little fish as unimpeded as before. These people declare even the present size limit for the plaice to be a hindrance to them — and they carry

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of far greater moment with us than it seems to be in England, the matter would have turned out very differently.

According to my preliminary investigations, the female eels as a rule do not breed till they are c. 19—20 inches long, while by far the greater number of males do not reach this length when full-grown. — Here the *propagation theory* would be obliged to require a size limit of at least 20 inches, in order to protect the stock of eels satisfactorily; but *then the males could not be caught at all.* The *growth theory,* on the other hand, requires only that the eels have reached a *suitable market value* before they are caught, and this will, presumably, be attained at considerably under 20 inches. How this question may be solved will be further discussed in a succeeding report. The remarkable thing in the eel-fisheries, in contradistinction to all other fisheries, is, we know, that they are and must be based on catching eels *that have never spawned* — as far as we are acquainted with the biology of the eel at present. — (See my preliminary note: »On the breeding-dress of the eel« in »Dansk Fiskeriforenings Medlemsblad«, p. 421 seqq., 1893).

on, I dare say, rather a considerable smugling trade with them, dried. I have not thought it necessary during my investigations to enter into these matters which concern the police only; but so much is sure, if minimum regulations are ever to be of any consequence with respect to the plaice in the Cattegat, then at least the *wholesale trade* in fish under the size limit must be forbidden and *prevented* by an effective control on land at these places.

The whole profit on little fish at these places, calculated in money, is scarcely of any great value, but where the income is small beforehand, will any diminution in it, however insignificant, be met with complaints. The whole matter would be without any further import, *if it did not prey upon the very root of a greater matter: the plaice-fishery in the whole Cattegat.*

A proposition to introduce regulations with respect to the size of the meshes at these places, instead of a size limit of the fish, has the usual drawbacks of such regulations, and would be just as unpleasant to the fishermen as a size limit, if it were to lead to the wished-for result, viz. the protection of the young fish. —

By fixing a size limit for *the sole*, *the turbot*, and *the brill* there are not so many practical things to take into consideration as with the plaice; for those fish are not to the same degree as the latter indispensable for the fishermen; as a rule they only take them when they are caught accidentally, and the population can live very well, even though they stayed away from the fishing-grounds for a year. — Further, there is the advantage that we need only fix one size for each species in our seas, with the exception of *the turbot* at Bornholm; for the small specimens of turbots in our Fjords cannot be taken into consideration; they are rather to be looked upon as fry of the turbot from the Cattegat. *The sole* and *the brill* are, so to speak, fished in the Cattegat only, and of these fish, as far as we know, there is only one race. — As these three species of fishes are not by far so common as the plaice, I have only scarce information to give of them; but as they live in numbers in the Cattegat and Skager Rack only, because they are more of a sea-fish than the plaice, we may with respect to them expect much likeness, biologically, to the same species in the German Sea.

In the south of the Cattegat I have seen mature *male soles* of c. 8 inches and mature female ones of c. 9 inches; this agrees very well with *E. W. L. Holt's* observations in the German Sea, and his size limit of 12 English inches agrees very well with the wishes of many fishermen at Frederikshavn, 10 inches to the base of the caudal fin. This latter size must be supposed to be quite suitable pro tem. in our seas; whether, after all, it would not be well to fix it still higher can be proved only by future investigations and experiments.

As to *the turbot* in the Cattegat I can say that the milters often become mature at a somewhat smaller length than in the German Sea; but there does not seem to be any greater difference between the spawners in these two seas. When therefore in England a size limit of 18 English inches is proposed, a size limit of c. 15 Danish inches does not seem too high with us, i. e. a turbot of c. 12 inches to the base of the caudal fin, or weighing as a rule about 2 lbs., a size which is also considered suitable by the fishmongers, as a turbot over 3 lbs. is generally paid for more than three times as much per lb. as one under 3 lbs.

For Bornholm a weight of c. $1^1/_2$ lb. is minimum size with respect to this fish, a size which I think may be considered suitable there. The question is there but of slight import.

With respect to *the brill* it is supposed, according to our present knowledge of this fish, that c. 14 inches will be suitable with us, a length, consequently, of c. 12 inches to the base of the caudal fin — a fish of between 1 and 2 lbs.

It is presumed that it will be far more advantageous *in future to make the size limits considerably higher* both for turbot and brill. For these fish can reach a much larger size than the proposed size limits, the turbot 25 inches with a weight of c. 25 lbs., and the brill c. 24 inches, though with a considerably lower weight; but the proposed size limit will already be a good step onward, compared to the present ones which for both species are only 8 inches to the base of the caudal fin.

It is evident that fish which, when they reach their normal, mature size, are so much larger (and broader) than the plaice as the two said species are, must have suffered proportionally more by the eager fishing in the Cattegat than the plaice has done; for the size of the meshes which has been used has for this fish not been so unproportionally small as for turbot and brill. We might really be tempted to believe that there are not, perhaps, enough of the mature fish to produce sufficient numbers of fecundated eggs of these two species. I shall not here enter further into the question, how far artificial fecundation, carried on by every fisherman who catches mature specimens of turbot and brill, and the placing of these eggs in the sea, might be of any use. The matter would be, if the fishermen would take an interest in doing so, without any cost to anybody, as the ripe eggs and the milt were only to be pressed out of the fish into a dish, and then thrown into the sea, while the fish would be nearly as good a commodity after all.

Résumé: It must be supposed that regulations to prevent abuses of too small fish *(plaice, soles, turbots,* and *brills)* in Danish seas will protect the stock sufficiently, and add considerably to the profit of the fishery; but *this will be attained only when the size limit of these fishes are made sufficiently high. No perceptible improvement can be expected from small size limits.*

Tillæg I.

Fortegnelse

over de Steder (Nr. 1—238), paa hvilke

Flynderfiskenes Forekomst
i danske Farvande

nøjere er undersøgt med

dertil egnede Fiskeredskaber,

i 1892 og 93.

Undersøgelserne Nr. 1—56 ere udførte i 1892 ombord paa Kanonbaaden »Hauch« eller Kontrolskibet »Havørnen« af C. G. Joh. Petersen, se dog Nr. 29. Til Nr. 1—5 er brugt Tungevaad, til Nr. 11—56 derimod et Snurrevaad med smaa Masker (oprindelig konstrueret til Fangst af Aal), hvor intet andet Redskab, saasom Rejehov udtrykkelig er nævnt. —

Undersøgelserne Nr. 57—166 ere alle udførte ombord paa »Hauch« i 1893 af dens Næstkommanderende, Premierløjtnant C. J. Hansen. — I de Tilfælde, hvor Hansen ikke har været aldeles sikker paa Arts-Bestemmelsens Rigtighed, har han tilføjet »usikre«; hvor han ikke har ment at kunne udtale sig nærmere om Arten, er Ordet »Fladfisk« brugt i Betydning *Genus: Pleuronectes*; iøvrigt er der ved Fladfisk under 2″ Længde vedføjet et H eller P, hvilket betyder, at enten Hansen eller Petersen indestaar for Bestemmelsens Rigtighed; — jeg har nemlig senere undersøgt de smaa hjembragte Fisk.

Til Snurrevaaddene, snart stor-, snart smaamaskede, brugtes 300 Fv. Line paa hver Arm af Vaaddet; til Landdragning brugtes (paa de samme Vaad) enten ganske korte Liner eller der blev vadet med Vaaddet over Sandene. Til Tobisvaad brugtes fra 60—100 Favne, eftersom det anvendtes paa lægere eller dybere Vand.

Nr. 62, 75—86, 134, 135 falde ved Bornholm. Nr. 74, 100—127, 133, 136, 137, 166 i Østersøen ved Rødsand, Kjøge, Møen, Gjedser, Darserort; de andre Nr. falde i vore andre Farvande, ofte flere paa samme Localitet til forskjellige Tider (se Henvisningerne). —

Undersøgelserne Nr. 167—238 ere alle udførte af Petersen, enten i selve den biologiske Stations Nærhed (særlig Nr. 223—238) ved Kjerteminde i Tiden fra 4de April til 30te September, eller fra den biologiske Stations Sejlbaad »Makrelen« paa forskjellige Steder i Farvandene rundt om Fyen og Samsø, samt ved Lolland, Falster og Sjællands vestlige og sydlige Kyster.

Redskaberne have været dels Rejehov, dels Tobisvaad, dels stormaskede og smaamaskede Snurrevaad, hvilke sidste ere konstruerede særlig til dette Brug af biologisk Station.

Angaaende Brugen af Snurrevaad henvises til Drechsel: Oversigt over vore Saltvandsfiskerier. 1890.

Foruden de her nævnte Undersøgelser over Flynderfiskenes Forekomst ved vore Kyster og særlig de yngre Individers Opholdssteder er der gjort Undersøgelser over de af Fiskere fangede Fisk. Disse ere blevne indkjøbte paa Fiskepladserne og undersøgte, dels af C. G. Joh. Petersen, dels af Musæumsassistent, cand. mag. H. J. Posselt, dels af stud. mag. E. Bay, se herom de efterfølgende Tabeller over de maalte Fisk.

Endelig har jeg ved Fiskerikontrolløren for Jyllands Velvilje gjennem Assistent Tranum faaet gode Oplysninger om Størrelserne af de Rødspætter, der af Fiskere fanges i Limfjorden; se herom Tabellerne.

At jeg paa mange Maader og til meget forskjellige Tider udenfor de her opskrevne Tilfælde har søgt og erholdt Oplysninger paa det foreliggende Omraade, behøver jeg vel kun at nævne, — jeg takker herved alle de Mænd, saavel Fiskere som Fiskehandlere og andre, der godhedsfuldt og uegennyttig have ydet mig deres Bistand ved mine Undersøgelser.

Undersøgelser i 1892.

Nr. 1. Øst for Bangsbo høje Land. 3 Favne. Sandbund. Tungevaad med 100 Favne Line paa hver Arm. — 23. Marts.

Aldeles ingen Fisk.

Nr. 2. Paa samme Sted. Tungevaad. — 23. Marts. — Med c. 200 Fv. Line. 3 smaa Rødspætter, 4 Isinger.

Her er aabenbart næsten ingen Fisk paa denne Aarstid.

Nr. 3. Lidt længere ud til Søes paa 6 Favne; noget blødere Bund. Tungevaad. — 23. Marts.

1 Rødspætte, 11 Isinger og en *Motella mustela*.

Nr. 4. 23. Marts. — Lidt længere ude paa 12 Favne Vand. Tungevaad. Blød Bund med Aphrodite, Pagurer etc.

16 Rødspætter, c. 12 Isinger, 1 Skrubbe, 4 Haaisinger.

Nr. 5. 23. Marts. — Endnu længere ude paa 14 Favne. Tungevaad. Blød Lerbund med *Buccinum*, *Brissopsis lyrifera*.

1 Tunge (*S. vulgaris*), 1 Slethvarre, 2 Pighvarrer, en Del Rødspætter og Isinger, enkelte Skrubber og Haaisinger, 2 store, Syngnather.

Mødte nogle Garnfiskere, der havde fisket med Nordre Rønner i SSV. og paa 14 Favne. Der var Sten, saa Vaaddræt kan ikke gjøres der.

De havde store Tunger, Rødtunger (*Pl. microcephalus*), Rødspætter, enkelte Torsk, Skader etc.

Nr. 6—10. 26. Marts. — Udfor Strandby og Jerup paa 3—4 Favne. Smaamasket Snurrevaad.

Mange unge Rødspætter, mange Isinger, enkelte Ulke, 1 Sildeunge, smaa Torsk (c. 5—6″), smaa Hvillinger (c. 6—7″).

2 Træk hindredes, rimeligvis af gamle Ankere.

Nr. 11. 26. Marts. — Udfor Frederikshavns Havn. 5 Favne. Tang og Smaasten.

En Del Rødspætter og Isinger, enkelte Aalekvabber, 2 *Gobius minutus*, smaa Torsk og Hvillinger, nogle Ulke, de mindste c. 4″.

Nr. 12—13. 28. Marts. — Nord for Hirtsholmene. 9 Favne. Sømus, *Aphrodite, Crangon, Asterias* etc.

Mængder af smaa Isinger, færre Rødspætter, 1 Slethvarre, c. $5^3/_4''$ lang, 1 *Arnoglossus laterna*, 2 *Callyonymus lyra*, *Gobius minutus*, 4 *Agonus*, store og smaa Hvillinger, 3 Rokker paa c. 12″ med Halen.

Nr. 14. 28. Marts. — NV. for Hirtsholmene. 5—6 Favne.

2 Slethvarrer, c. $4^1/_2$ og 5″, 7 store Isinger, en Del Rødspætter, 1 *Pl. microcephalus*, Ulke, *Gobius minutus*, 2 Sildeunger, 1 Hvilling.

4 Arter af pelagiske Æg iagttoges i Vandet; af disse kunne de tre maaske være Rødspætte-, Torske og Skrubbeæg, men nøjere Undersøgelse kunde ikke foretages.

Nr. 15. 4. April. — Koldingfjordens Munding. 9 Favne.

En 5″ lang Rødspætte, en Del smaa Isinger.

Nr. 16. 4. April. — Paa Flesingen. Sandbund.

Mange Torsk og store Isinger med megen, dog ikke moden Rogn.

Nr. 17. 4. April. — Inde i Gamborg Fjord. 7 Favne. Mudder og raadden Tang.

2 store Skrubber, Isinger, 1 Rødspætte, 1 *Carcinus mænas* »i Dvale«.

Nr. 18. 4. April. — I Gamborgfjordens Munding. 10 Favne.

Omtrent som foregaaende.

Nr. 19. 5. April. — Nord for Fænø Kalv. 11 Favne. Stykker af Laminarier o. a. Alger.

Buccinum, 1 *Fusus*, Svampe, *Arterias*, 1 lille *Solaster papposus*, *Bryozoa*, 5 Torsk og 2 Isinger.

Nr. 20. 5. April. — Paa Sandet ved Stenderup-Hage.

2 Rødspætter paa $3^3/_4''$ og 1 paa 7″, 1 Skrubbe med megen Rogn, enkelte Isinger og Torsk.

Nr. 21. 5. April. — I Binnerup Bugt. 7 Favne.

Megen død *Zostera*, *Furcellaria*, *Delesseria* etc., *Hippolyte*, *Asterias*, *Ophiurer*, *Idothea*. Mange Isinger, saavel smaa som store, 2 Skrubber, *Gobius Ruthensparri* og *minutus*, 2 Naalefisk, Ulke, *Gunellus*, 3 Torsk.

Nr. 22. 5. April. — Syd for Flækøjet. 10 Favne.

Megen død *Zostera*. *Hippolyte*, *Carcinus*, Isinger og nogle faa legende Skrubber.

Nr. 23. 5 April. — Midt i Binnerup Bugt. Mudderbund med megen voxende *Zostera*, saa Vaaddet trillede aldeles sammen.

Nr. 24. 22. Maj. — Paa Søgrunden og Svanegrunden ved Horsensfjorden afsøgtes Terrainet for at finde Sandbund til at trække Vaad paa efter smaa Fladfisk, men der fandtes paa lavt Vand (1—2 Favne) kun pletvis Sandbund, ellers var Bunden bevoxet med kortere eller længere *Zostera* og forskjellige Alger.

Vaaddet gav: 1 Slethvarre, 1 Ising, Ulke, smaa Torsk, *Spinachia*, *Gasterosteus*, *Gobius Ruthensparri*, men ingen andre smaa Flynderfisk.

Nr. 25. 23. Maj. — Ved Bjørnsknude paa 1—2 Favne. *Zostera* og Sten, kun Sand i Pletter; umulig at drage Vaaddet der.

Et Træk ved Land gav 1 Skrubbe og Ulke.

Nr. 26. 23. Maj. — Paa Sandrevlerne ved Hasenøre (Ebeltoft) fangedes ved Vadning med Vaaddet en Del store og smaa Skrubber, men kun 1 Rødspætte.

Nr. 27. 23. Maj. — Samme Sted paa 4 Favne.

Isinger, Smaatorsk, Ulke, Aalekvabber, Hundestejler, *Spinachia*.

Nr. 28. 24. Mai. — Udfor Grenaa. $4^1/_2$—7 Favne.

5 Slethvarrer gydende, en Del Rødspætter paa 8—12″, Isinger, enkelte Skrubber, 1 *Trigla*, 2 *Agonus*, *Syngnather*.

Nr. 29. 26. Mai. — Hos Fiskere i Hadsund.

I Aalehaandvaad mange Skrubber og en Del Rødspætter paa 5—6″, Aal etc.

Nr. 30. 27. Mai. — Udfor Limfjorden ved Hals. $3^1/_2$ Fv.

13 Rødspætter, en Del Isinger, 2 *Trigla*.

Nr. 31. 27. Mai. — Paa lavt Vand ved Hals. Ved Vadning med Vaad og Rejehov.

Mængder af smaa Rødspætter, f. Ex. c. 200 i et lille Træk.

Nr. 32. 16. Juni. — Paa Thorø-Sand udfor Assens.

Ingen smaa Flynderfisk.

Nr. 33. 17. Juni. — Marstals Omegn.

Sandgrundene undersøgtes her ved Vadning og Roning med Jolle, men de ere her kun pletvis bare. Med Vaad fangedes en Del store og smaa Skrubber og enkelte c. 5″ lange Rødspætter foruden andre Fisk.

Nr. 34. 18. Juni. — Gjordes flere Træk syd og vest for Ærø, men alle Steder Sten eller paa dybt Vand Vrag?, saa der fangedes intet.

Nr. 35. 21. Juni. — Syd for Endelave. 14 Favne. Mudderblandet Slik uden Plantevæxt, men med megen død *Zostera*.

Enkelte *Amphidetus*, *Ophiurer*, *Buccinum*, *Fusus*, 2 *Hyas*, 3 Rødspætter, smaa og store Isinger, Haaisinger, 5 *Lumpenus* fangedes, men nogle saas undslippe, *Zoarces*, Ulke, *Agonus*, 1 *Raja*.

Nr. 36. 21. Juni. — Øst for Endelave. 7 Favne.

En Del Alger. En Snes Smaatorsk, et Par Snese Isinger, *Zoarces*, 1 *Spinachia*, enkelte Ulke.

Nr. 37. 21. Juni. — Udfor Koldby Kaas paa Samsø.

Forsøgt at trække, men Sten.

Nr. 38. 22. Juni. — SO. for Marthas Flak. 10 Fv.

Echinus Dröbakienis, *Asterias*, *Ophiurer*, *Solaster*, *Pagurer*, *Astropecten*, *Modiola* med *Actinier* etc.

Mange Isinger, enkelte Haaisinger, 1 Rødspætte c. 8″, Ulke, *Agonus*, 1 lille Torsk, 1 lille Hvilling, 2 ganske smaa *Raja*, 1 raadden *Cyclopterus*.

Nr. 39. 24. Juni. — Nord for Anholts Fyr. 10 Fv.

Furcellaria. *Arterias*.

Enkelte store Rødspætter, flere Hundrede Isinger, hvoraf enkelte store, 1 Haaising, 2 *Arnoglossus laterna*, 1 lille *Trigla*.

Nr. 40. 27. Juni. — Midt paa Aalborgbugten. 5 Fv. Sand med *Halidrys* o. a. Alger.

Asterias, Echinus Dröbakiensis, Pagurer etc.

1 Snes store Rødspætter, Mængder af Isinger, et Par Snese smaa Torsk, 1 Rokke.

Nr. 41. 29. Juni. — Øst for Frederikshavn. 21 Favne.

Pennatula, Brissopsis etc.

2 Rødspætter, Haaisinger, 1 *Pl. cynoglossus*, enkelte Isinger, 1 Torsk, 5 *Collyonymus maculatus* med megen, dog ikke moden Rogn.

Nr. 42. 29. Juni. — Øst for Hirtsholmene. 14 Favne.

Brissopsis, Astropecten, Asterias, Turritella etc.

En Snes Rødspætter, mange smaa Isinger, enkelte Haaisinger, 2 mindre *Pl. microcephalus*, 1 *Arnoglossus laterna*, smaa *Trigla*, 8 smaa Rokker.

Nr. 43. 29. Juni. — NO. for Hirtsholmene. 8 Favne.

Lidt *Zostera* og *Fucus*, maaske løs.

En Del smaa Rødspætter, mange Isinger, faa Haaisinger, flere *Arnoglossus laterna*, 1 lille *Solea*, 2 *Callyonymus lyra* ♂ (flere *Call. maculatus?)*, Smaatorsk, smaa Hvillinger, smaa Knurhaner, smaa Rokker, enkelte *Agonus*.

Nr. 44. 29. Juni. — NV. for Hirtsholmene. 4 Fv.

Nogen kort *Zostera*.

Mange smaa Rødspætter, smaa Isinger, 2 *Arnoglossus laterna*, *Collionymus*.

Nr. 45. 30. Juni. — Frydenstrand ved Frederikshavn.

Ved Vadning med Vaad og Rejehov:

En Del smaa Rødspætter paa ca. $^1/_4$—2″.

Skrubber i Mængde, ganske smaa og nogle mellem 3—4″, 3 smaa *Solea vulgaris* paa 3—$4^1/_2$″.

Nr. 46. 1ste Juli. — Mellem Knallens og Flyndergrundens Vagere, øst for Læsø paa $6^1/_2$ Fv.

Nogen *Zostera, Echinus miliaris, Asterias*.

2 Rødspætter, 3—4 Snese større Isinger, Smaatorsk, 1 Aalekvabbe, 1 *Arnoglossus laterna*, 2 Haaisinger, Ulke, 1 *Trigla*, 1 ♀ *Callionymus lyra*, 1 Hundestejle (3 pig).

Nr. 47. 1. Juli. — Noget længere østlig. 10—15 Fv.

Brissopsis, Luidia, Asterias glacialis, Svampe.

1 Rødspætte, 30 Isinger, en Snes Haaisinger, 3 *Pl. microcephalus*, 23 *Arnoglossus laterna*, 1 lille *Trigla*, 1 lille Rokke.

Nr. 48. 1. Juli. — Endnu længere østlig. 27 Favne.

Løse Alger. *Brissopsis* etc.

Mange Haaisinger, enkelte smaa Isinger, enkelte *Pl. microcephalus*, 1 *Zeugopterus norvegicus*, 2 *Callion. maculatus*, 1 lille *Merluccius* paa $5^3/_4$″.

Nr. 49. 1. Juli. — Endnu længere østlig. 38 Fv.

Brissopsis, Ophioglypha Sarsii, 2 nøgne Snegle.

Mange Haaisinger, 2 *Zeugopterus norvegicus*, 1 ung *Merluccius* $5^3/_4$″, 1 *Callion. maculatus*, 1 lille Rokke.

Nr. 50. 1. Juli. — 2 Kvartmil NV. for Kobbergrundens Fyrskib. 10 Fv.

Alger. — *Asterias, Phallusia parallelogramma.*

Mange, mest smaa og halvvoxne Isinger, en Del Rødspætter, 46 *Arnoglossus laterna,* 8 *Callion. lyra,* 1 Torsk, smaa *Trigla.*

En Fiskekutter i umiddelbar Nærhed fik i sit Vaad c. 100 Rødspætter, nogle Isinger, 2 *Cyclopterus* (♂), 2 Slethvarrer, en Ægmasse af *Cyclopterus,* men ellers intet.

Nr. 51. 1. Juli. — N. for Groves Flak. 27 Fv.

Blød Slik.

Pecten septemradiatus, Nucula, 1 *Rossia,* 1 *Astrogonium, Brissopsis.*

3 Haaisinger, 1 *Pl. cynoglossus,* 6 *Callion. maculatus.*

Nr. 52. 2. Juli. — Udfor Bangsbo. 2 Fv.

Sand og løse Alger.

Mange smaa Rødspætter, enkelte Isinger, 1 lille Torsk, 1 lille *Trigla.*

Nr. 53. 2 Juli. — Vadning ved Bangsbo gav kun Skrubbeunger, men ingen fra iaar og aldeles ingen Rødspætter.

Nr. 54. 2. Juli. — Nord for Sæby. V. Vind. Vaaddet draget til Land.

4—5 *Solea vulgaris,* 1 Rødspætte, 1 Skrubbe, 1 *Osmerus eperlanus,* 6 Aal og utallige Masser af Sildeyngel, hvori kunde skjelnes 2 Størrelser, hvoraf den mindste kun var Larver endnu. Vaaddet fyldtes aldeles af løse Alger, derfor kunde Sildene ikke undslippe.

Nr. 55. 2. Juli. Samme Sted.

2 smaa Pighvarrer paa 5 og 5¼″, 3 Aalekvabber, 1 Aal og Mængder af Sildeunger.

Nr. 56. 29. September. — Ved Aalbæk.

Der gjordes 5 Træk paa og imellem Revlerne fra Land og ud til 4 Favne.

En Del smaa Rødspætter (½ og 1½ aarige), 5 ***Rhombus lævis*** paa 3—4″, Isinger, enkelte Skrubber, Hvillinger, 2 *Spinachia,* 2 *Gobius minutus.*

Undersøgelser i 1893 ombord paa „Hauch“.

Nr. 57. Den 22de Marts, stormasket Snurrevaad, 1 Kvml. Ø. for Hirtsholmene paa 15 Fv. Slik.

9 Rødspætter 9—13$^{1}/_{2}$", ialt 5 Pd.

8 Skrubber ♀ paa nær 2 med moden Rogn 9$^{1}/_{2}$—13"
4 Skrubber ♂ med moden Mælk, 9$^{1}/_{2}$—10$^{1}/_{2}$" } se Nr. 165, $^{27}/_{10}$ 93.
4 Isinger, 4—10$^{3}/_{4}$".

4 Rokker, desuden Sømus, Søfjer, Guldmus, Søstjerner, Søpunge, Søpindsvin, Eremitkrebs, *Zostera* (død) { Temp. i Overfl. 3,$_{3}$ ^{0}, Salth. 3,$_{27}$ $^{0}/_{0}$.
— v. Bund 2^{0}, — — }

Nr. 58. Den 22de Marts, storm. Snurrevaad. — 3 Kvml. N. for Læsø Rende Fyrskib. — 12 Fv.

35 Rødspætter, 9—13$^{1}/_{2}$".

5 Skrubber ♀ 9—11" med moden Rogn { Temp. i Overfl. 3^{0}, Salth. 3,$_{32}$ $^{0}/_{0}$.
5 Skrubber ♂ 9—11" med moden Mælk { — i Bund 2^{0}, — 3,$_{38}$ $^{0}/_{0}$.

2 Slethvar 12 og 13$^{1}/_{2}$".

1 Ising 10". — Søstjerner, Søpindsvin, Eremitkrebs, *Zostera*, *Fucus serratus* og *vesiculosus*.

Nr. 59. Den 24de Marts, storm. Snurrevaad. I Læsø Rende. $^{1}/_{2}$ Kvml. SSV. for NV. Revets Vager. 18 Fv. Blød Bund.

5 Rødspætter 11$^{3}/_{4}$—13$^{1}/_{2}$", 1 Tangsprælle 3".

4 Isinger 8$^{1}/_{2}$—11".

Søanemoner, Søstjerner, Eremitkrebs, Søpindsvin, samt raadden *Zostera* og *Laminarier*.

Nr. 60. Den 26de Marts, bundsatte Garn, som stod SO.—NV. i sønden for Frederikshavns Havn i 5 Fv.

7 Rødspætter 8$^{1}/_{4}$—10$^{1}/_{2}$".

22 Isinger 8—9$^{3}/_{4}$".

1 Skrubbe 10" samt 5 Stenbidere 2 ♂ og 3 ♀.

Søstjerner.

I stormasket Snurrevaad samme Dag ved Nordre Rønner, 20 Fv., blød Bund, fandtes 2 Tunger 16″, 2 Pighvar 12—18″, en Lampret, Torsk og Isinger.

Nr. 61. Den 4de April med Travl, $5^1/_2$ Kvml. misv. Ø. for Olenburg Huk Fyrtaarn paa Femern. 16 Fv. Slik.
13 Isinger $2^1/_2$—$7^1/_2$″, 1 Rødspætte $6^1/_2$″.
2 *Lumpenus* $7^1/_2$—$9^1/_2$″, 5 Ulke.
1 Pandserulk, 1 *Gobius niger*. Temp. i Overfl. $3,_7{}^0$, Salth. $0,_{78}$ %.
1 Aalekvabbe. Temp. v. Bund 2^0, Salth. $1,_{72}$ %.
Trawlen var ude i c. 25 Min.

Nr. 62. Den 7de April, bundsatte Garn udfor Nexø, Bornholm, i 8 Fv. i Fyrlinien. Sand. (Se Nr. 78, 80).
141 Rødspætter $7^1/_2$—13″, mange udlegede (40 Pd.).
20 Skrubber $9^1/_4$—14″, udlegede, 8 Pd.
3 Isinger, umoden Rogn, $^1/_2$ Pd.
2 Pighvar 8—13″, umoden Rogn, Maven tom, 2 Pd.
3 Stenbidere 8″, og 4 Torsk $9^1/_2$—14″.

Nr. 63. Den 10de April, bundsatte Garn udfor Refshalen (Sundet) i 3—5 Fv. Fangsten var kun i den Del af Garnet, som stod paa det grundeste.
16 Isinger $8^1/_4$—$10^1/_4$″.
5 Rødspætter $1^1/_2$ Pd., 6 Skrubber 3 Pd.
2 Pighvar 8—14″, 4 Stenbidere.
1 Torsk $20^1/_2$″.
To andre Garnsætninger de følgende Dage gav kun 1 Pd. Rødspætte hver Gang.

Nr. 64. Den 23de April med smaamasket Vaad (Vadning) paa Sandene ved Mariagerfjords Udløb. (Se Nr. 65).
30 Skrubber 2—$3^1/_2$″ (flest paa $2^3/_4$″). Temperaturen var $9^1/_2{}^0$.
25 Skrubber 4—$6^1/_2$″ (flest paa 5″). Saltholdigheden $2,_{20}$ %.
Yngel af Aalekvabber og Hundestejler.

Nr. 65. Den 23—24de April, Sættegarn, udenfor Barren ved Mariagerfjord. Sand. 3—4 Fv. (Se Nr. 64).
294 Isinger $7^1/_4$—$11^1/_2$″ (deraf 37 med moden Rogn), vejede ialt 71 Pd.
20 Skrubber $8^3/_4$—13″, udlegede, 7 Rødspætter $6^1/_2$ Pd.
3 Stenbidere, 1 Torsk, 4 Pighajer (35″), hvoraf 1 med 10 Unger, mange Søstjerner.

Nr. 66. Den 30te April, Sættegarn i Vej-Dybet ved Hals fra 2—4 Fv.
60 Skrubber 5—$12^1/_2$″ (deraf kun 2 med moden Rogn).
37 Isinger ♀ $8^1/_4$—$11^1/_2$″ (2 med moden Rogn).
5 Isinger ♂ $8^1/_4$—$11^1/_4$″.
3 Rødspætter, 4 Torsk, 1 Stenbider.
Samtidig med Rejehov paa Sandene: 3 Rødspætter (P.*)) paa $^1/_2$″.

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*) Anm.: (P.) betyder bestemte af C. G. Joh. Petersen.

Nr. 67. Den 5te Mai, Sættegarn udfor Karrebæksminde i 3 Fv.

68 Isinger $8^1/_4$—$11^1/_2$".

1 Pighvar ♀ med umoden Rogn 13", $1^1/_4$ Pd.

5 Rødspætter 10—13".

7 Skrubber 9—$12^3/_4$".

Nr. 68. Den 8—9de Mai, Sættegarn S. for Hesselø i 4—6 Fv. Sand og Slik.

15 Isinger ♀ $6^3/_4$—$10^1/_4$".

6 Isinger ♂ $6^3/_4$—$7^1/_2$".

1 Rødspætte 11", 1 Skrubbe 11".

1 Haaising $10^1/_2$", 1 Stenbider.

Krabber og Snegle.

Nr. 69. Den 8de Mai, med smaamasket Vaad paa Lysegrundens O.-Side i 5—8 Fv. Sand og længere ude Slik.

61 Isinger ♀ $4^1/_2$—$8^1/_2$" }
46 Isinger ♂ $5^1/_2$—$7^3/_4$" } 7 modne.

3 Ulke, 1 Aalekvabbe 12".

1 venstrevendt Ising.

{ Vandets Temperatur i Overfladen $9{,}_2{}^0$, Salth. $1{,}_{93}$ %. }
{ — — i Bunden $8{,}_5{}^0$, — $1{,}_{92}$ - }

Nr. 70. Den 12te Mai, med Rejehov i Strandkanten ved Bangsbo Strand. Sand. (Se Nr. 88, 91, 142, 143 og 162).

24 Rødspætter $1^3/_4$—$3^1/_4$" (rimeligvis fra ifjor) (H.*) samt 2 paa $4^1/_4$ og 7".

6 Skrubber 2—$6^1/_4$" samt 9 Fladfisk.

Aaleyngel i Bækken c. 4".

Ved Bangsbostrand blev der Aaret igjennem foretaget Undersøgelser med c. 1 Maaneds Mellemrum, og tildels paa samme Maade, idet der den første Tid anvendtes Rejehov og smaamasket Vaad, og i Efteraaret Tobisvaad. Bunden er Sand med store Sten hist og her, og midt i Bugten løber en lille Bæk ud. Fra 20—50 Alen fra Kysten findes med daglig Vandstand næsten tørre Revler, med 3 à 4 Fod Vand indenfor. Her som overalt paa flad Strandbred viste det sig, at man fik rigeligere Fangst med Lavvande, da dette letter Fiskeriet.

Nr. 71. Den 13de Maj, Nord for Frederikshavn i Strandkanten med Rejehov. Ogsaa her findes Revler med Sand, men helt i Land findes smaa Sten med mere lerblandet Sand.

45 Rødspætter (P.) $^3/_8$ – $^3/_4$" }
22 — $2^1/_4$—$4^1/_4$" } paa den næsten tørre yderste Revle.

7 Skrubber $4^1/_2$—$5^1/_2$", heraf 1 paa den yderste Revle, de andre helt inde i Strandkanten.

Desuden Yngel af Aalekvabber, Hundestejler, Kutlinger og Aal.

Nr. 72. Den 17de Mai, med smaamasket Landdragningsvaad paa Nordsiden af den lave Vestpynt paa Hjelm. Inde i Strandkanten findes en Bræmme af

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*) Anm.: (H.) betyder bestemte af C. J. Hansen.

Rullesten, paa 4 à 5 Fod Vand nogne Sandpletter mellem de algebevoxede Dele af Bunden. Her er vist daarlige Forhold for »Yngel« af Fladfisk.

10 Rødspætter $8^{3}/_{4}$—$13^{1}/_{4}$″.

19 Skrubber 8—$14^{1}/_{4}$″, 6 Isinger $5^{1}/_{2}$—$7^{3}/_{4}$″.

12 Slethvar 5—$10^{3}/_{4}$″, 4 Pd., 2 *Trigla.*

— — — Paa Sletterhage gav Landdragningsvaad paa Grund af Sten i Strandkanten kun ringe Udbytte: 3 Skrubber, 1 Ising.

Nr. 73. 17—18de Mai, bundsatte Garn, $^{1}/_{2}$ Kvml. NO. for Trekosten paa Øreflakket fra 4—9 Favne.

50 Isinger ♀ $7^{1}/_{4}$—$11^{1}/_{2}$″, 16 moden Rogn.

9 Isinger ♂ $7^{1}/_{2}$—$9^{3}/_{4}$″, 4 moden Mælk.

1 Slethvar $15^{3}/_{4}$″ med fuldmoden Rogn.

5 Rødspætter $10^{1}/_{4}$—$13^{3}/_{4}$″, 1 Skrubbe 12″.

1 Rokke, 24 Stenbidere 103 Pd.

1 *Agonus.* (Garnene bleve stærkt beskadigede).

Nr. 74. Den 25de Mai med smaamasket Vaad. 7 Kvml. S. O. for Møens Fyrtaarn i 11 Fv. Sand.

209 Rødspætter 5—$16^{1}/_{4}$″ (overvejende fra 6—9″).

84 Isinger $3^{3}/_{4}$—$8^{3}/_{4}$″ ⎧ Temp. i Overfl. $8{,}_{3}{}^{0}$, Salth. $0{,}_{66}\,{}^{0}/_{0}$. ⎫
5 Ulke, 1 Aalekvabbe ⎩ — ved Bund $8{,}_{0}{}^{0}$, — $0{,}_{79}\,{}^{0}/_{0}$. ⎭

Nr. 75. Den 25—26de Maj. Sættegarn udfor Hasle i 10 Fv. Sandbund.

65 Skrubber $8^{1}/_{4}$—13″.

15 Rødspætter, 3 Ising 6″, 2 Torsk 15—22″.

1 Pighvar $11^{3}/_{4}$″, næsten moden Mælk, $1^{1}/_{4}$ Pd.

Nr. 76. Den 26de Mai. Smaamasket Vaad. 1 Kvml. NV. for Hammerens Fyrt. i 10 Fv. Sand.

6 Rødspætter $6^{3}/_{4}$—$10^{3}/_{4}$″, 7 Skrubber 8—12″.

16 Isinger $4^{1}/_{4}$—11″, umoden Rogn og Mælk.

9 Ulke.

⎧ Temp. i Overfl. $8{,}_{0}{}^{0}$, Salth. $0{,}_{79}\,{}^{0}/_{0}$. ⎫
⎩ — ved Bund $5{,}_{0}{}^{0}$, — $0{,}_{79}\,{}^{0}/_{0}$. ⎭

Nr. 77. Den 26de Maj. Smaamasket Vaad i Sandvig Bugt paa 4 Fv. Vand. Sand.

60 Skrubber 7—$12^{1}/_{4}$″, udlegede.

7 Rødspætter 7—9″ ⎧ Temp. i Overfl. $8{,}_{0}{}^{0}$, Salth. $0{,}_{79}\,{}^{0}/_{0}$. ⎫
15 Isinger $5^{3}/_{4}$—9″ ⎩ — ved Bund $7{,}^{0}$, — $0{,}_{79}\,{}^{0}/_{0}$. ⎭

3 Pighvar ♂ $7^{1}/_{4}$—$7^{1}/_{2}$″, umoden Mælk.

Prøvede Landdragningsvaad inde i Stranden, men Forholdene vare daarlige for Vaaddet, Sten og Klipper generede overalt; trak over en bar Plet, men fik Intet.

Prøvede forskjellige Steder ned langs Østkysten af Bornholm fra Sandvig til Nexø, f. Ex. udfor Dynddaleaa og Seene Baadested. Strandkanten egnede sig dog ikke for Vaadtræk, og hvor der fandtes bare Sandpletter af ringe

Udstrækning, f. Ex. udfor Bobbeaaen ca. 50 Alen fra Kysten paa 1 à 2 Fv. Vand, blev Fartøjet drægget op og Vaaddet brugt som Haandvaad, men der fandtes ialt kun 1 Skrubbe paa 8″.

— Udfor Gudhjem i 18 Fv. hang Vaaddet fast og maatte bjærges.

Nr. 78. Den 26—27de Mai. Sættegarn. Udfor Frederik Stenbruds Mølle ved Nexø i Fyrlinien, 8 Fv. Sand. Se Nr. 62—80.

53 Skrubber $8^1/_4$—$13^3/_4$″, 19 Pd.
19 Rødspætter $8^1/_2$—12″, $6^1/_2$ Pd.
5 Isinger $8^1/_2$—11″, $1^1/_2$ Pd.

Nr. 79. Den 27de Mai. Smaamasket Landdragningsvaad og Rejehov i Stranden nord for Snogebæk Havn (Bornholm). Sand. Se Nr. 134.

40 Skrubber $1^1/_8$—$2^1/_2$″ (med Hoven) (P.).
3 Skrubber $4^3/_4$—$5^1/_2$″.
19 Skrubber $7^3/_4$—$11^1/_4$″, og 1 Tobisunge.

Nr. 80. Den 28de Mai. Sættegarn Ved Nexø udfor Fredrik Stenbruds Mølle og Byens Mølle til Havnehovedet i 9 Fv. Stenbund. Se Nr. 62 og 78.

50 Skrubber, 18 Rødspætter $8^3/_4$—$10^3/_4$″, 4 Pd.
8 Isinger $8^1/_2$—$9^1/_2$″, 1 Pighvar ♂ $10^1/_4$″, $^3/_4$ Pd.

Nr. 81. Den 29de Mai med smaamasket Landdragnings-Vaad udfor Dueodde Fyrt. Sandbund.

17 Skrubber $1^3/_4$—$2^1/_2$″ (H.) og 6—$10^3/_4$″, 2 Pighvar 2″ og $2^3/_8$″.
1 Tangsnarre, 3 Laxørreder paa 11″.
En Del Ulke og Tobisyngel.

Nr. 82. Den 29de Mai lidt længere ude i 3 Fv. Sand.

20 Skrubber 7—$11^1/_2$″
4 Rødspætter $6^1/_4$—$10^3/_4$″
4 Ising 7—8″

Temp. i Overfl. $8,_2{}^0$, Salth. $0,_{79}$ %.
— ved Bund $7,_5{}^0$. — $0,_{79}$ -

Nr. 83. Den 29de Mai, storm. Vaad. 2 Kvml. SSO. for Dueodde Fyrt. i 18 Fv. Sand.

50 Rødspætter $7^1/_2$—12″, 10 Pd.
15 Skrubber $7^3/_4$—12″, 4 Pd.

Temp. i Overfl. $8,_5{}^0$, Salth. $0,_8$ %.
— ved Bund $4,_5{}^0$, — $0,_{78}$ -

16 Isinger $7^1/_2$—$10^1/_2$″.
4 Tangspræller — megen Vegetation.

Nr. 84. Samme Sted med smaam. Vaad.

162 Rødspætter $5^3/_4$—$11^1/_4$″, $25^1/_2$ Pd.
50 Isinger $3^3/_4$—12″, $5^1/_2$ Pd.
5 Skrubber $7^3/_4$—$11^1/_2$″, 2 Pd.
1 Torsk 11″ og nogle Ulke.

Nr. 85. Den 29de Mai. Storm. Vaad. 7 Kvml. SV. t. V. for Dueodde Fyrt. i 24 Fv. Sand.

16 Rødspætter $6^1/_2$—10″, $3^1/_4$ Pd.
12 Skrubber $7^1/_2$—12″, $3^1/_2$ Pd.
2 Isinger $4^1/_2$—9″.

Temp. i Overfl. 8^0, Salth. $0,_{79}$ %.
— ved Bund 4^0, — $0,_{77}$ -

Nr. 86. Samme Sted. Smaamasket Vaad.

70 Rødspætter 5—$10^1/_4$", $9^1/_2$ Pd.
3 Skrubber 9—10".
72 Isinger $2^3/_4$—$7^1/_2$", 3 Pd.

Temp. i Overfl. 8°, Salth. $0,_{79}$ $^0/_0$.
— ved Bund 4°, — $0,_{77}$ -

— — — Sættegarn udfor Rønne den $^{30}/_5$ 3 Pighvar ♂ $7^1/_4$" og ♀ paa 9" og $10^1/_2$" umoden Fisk, desuden nogle Rødspætter og Skrubber.

Efter Rognens Udseende og Fiskernes Udtalelser at dømme, maa Pighvarren antages at lege ved Bornholm i Juni Maaned. Der blev ialt fra $^{25}/_5$—$^{30}/_5$ fra »Hauch« fanget 10 Pighvar, deraf 6 ♂, 2 ♀ og 2 Unger.

Skrubbens Yngel fandtes i stort Antal; den voxne Fisk var gjennemgaaende større end Rødspætten og Isingen, saaledes var dens Maximumsstørrelse $13^3/_4$", medens den for de andre 2 Arter var 12". 1 Aargang Skrubber (de 1-aarige) manglede, dog findes en Antydning af denne Aargang i Nr. 79 fra Strandkanten nord for Snogebæk Havn (3 Stk. fra $4^3/_4$—$5^1/_2$"). Derimod saas der aldeles intet til de to yngste Aargange Rødspætter ($^1/_4$ og $1^1/_4$-aarige).

Nr. 87. Den 9de Juni. Smaamasket Snurrevaad, udfor Skagen By i 7 Fv. Sandbund.

60 Rødspætter 4—$11^1/_4$" (Hovedmassen fra 8—11"), deraf 35 paa $11^1/_2$ Pund.

442 Isinger $2^3/_4$—$8^1/_4$".
2 Rødtunger (*Pl. microcephalus*) 4" og 9".
15 Haaisinger 6—$10^1/_4$".
1 Rokke $7^1/_2$". 1 Hvilling $9^3/_4$".

Temp. i Overfl. $14,_2$°, Salth. $2,_8$ $^0/_0$.
— ved Bund 12°, — $3,_{54}$ -

— Samtidig toges med Tobisvaad, trukket til Land af Skagboerne, i et Træk:

105 Rødspætter 2—$4^1/_2$".
1 Skrubbe 4".

Nr. 88. Den 10de Juni. Smaamasket Landdragningsvaad og Rejehov. Stranden ved Bangsbostrand. Se Nr. 70, 91, 142, 143 og 162.

1 Rødspætte $8^1/_4$".
41 Rødspætter $2^1/_2$—$3^3/_4$".
28 Rødspætter $^3/_4$—1", med Rejehov (H.).
15 Skrubber $4^3/_4$—$9^1/_2$".
4 Skrubber $2^1/_4$—$3^3/_4$", oppe i Bækken.
4 Slethvar 4—$5^3/_4$".

Nr. 89. Den 14de Juni. Smaamasket Vaad paa Aalborgbugten, 21 Kvml. N. t. V. for Fornæs. 7 Fv. Sandbund.

1 Rødspætte 8".
142 Isinger $3^1/_4$—$9^1/_2$", de fleste med moden Rogn.
3 Torsk 5".
1 4-traadet Havkvabbe.

Temp. i Overfl. $17,_2$°, Salth. $1,_{82}$ $^0/_0$.
— ved Bund 14°, — $2,_{28}$ -

Nr. 90. Den 28de Juni. Smaamasket Landdragningsvaad og Rejehov øst for Gilleleje Havn. Sandbund med enkelte store Sten. Se Nr. 153.

10 Rødspætter $1^{1}/_{4}$—5″ (H.).
36 Skrubber 3—5″.
3 Pighvar $3^{3}/_{4}$—5″.
4 Tunger $3^{1}/_{4}$—5″.
2 Aalekvabber, 1 Naalefisk.

6 Kvml. VNV. for Gilbjerghoved i 10 Fv. ødelagdes Vaaddet fuldstændigt af noget i Bunden.

Nr. 91. Den 9de Juli med Rejehov i Strandkanten ved Bangsbostrand. Sand. Se Nr. 70, 88, 142, 143 og 162.

Rødspætter i Mængde fra 1—c. $1^{1}/_{2}$″ (H.) og endnu mindre Skrubber ned til $^{1}/_{4}$″ (P.). Enkelte smaa Hvarrer.

Nr. 92. Den 10de Juli med Rejehov i Strandkanten ved Anholt Nordstrand. Sand. Se Nr. 93, 96 og 155.

21 Rødspætter $1^{1}/_{4}$—$1^{3}/_{4}$″ (H.).
6 Slethvar $^{3}/_{4}$—$1^{1}/_{4}$″ (P.).
1 Pighvar $^{1}/_{4}$″ (P.).
Yngel af Hornfisk og Naalefisk.

Nr. 93. Den 11te Juli med Rejehov i Stranden paa Anholt Nordstrand. Sand. Se Nr. 92, 96 og 155.

12 Rødspætter $1^{1}/_{4}$—$1^{3}/_{4}$″ (H.).
4 Pighvarrer $^{3}/_{4}$—1″ (P.).
4 Skrubber $^{1}/_{2}$—$^{3}/_{4}$″ (P.).
(Garn ude i 8 Fv. nord for Anholt gav 7 Rokker $16^{1}/_{2}$—35″, tilsammen 50 Pd.).

Nr. 94. Den 19de Juli med smaamasket Vaad, 10 Kvml. S. $^{1}/_{2}$ O. for Fornæs Fyrt. i 4 Fv. Sand.

5 Rødspætter 11—$13^{1}/_{2}$″, 3 Pd.
10 Torsk $7^{1}/_{2}$—14″.
17 Isinger $4^{1}/_{2}$—$11^{1}/_{4}$″.
1 Slethvar ♂ $9^{1}/_{2}$″ og 1 *Agonus*.

Temp. i Overfl. $17{,}_{5}^{0}$, Salth. $2{,}_{02}$ $^{0}/_{0}$.
— ved Bund $15{,}_{0}^{0}$, — $2{,}_{43}$ -

Nr. 95. Den 19de Juli med Rejehov i Stranden nord for Grenaa Havn. Sandbund, lidt kalkholdig enkelte Steder. Se Nr. 140.

13 Rødspætter 1—2″ (H.).
20 Skrubber $^{1}/_{2}$—1″ (P.).
8 Pighvar $^{3}/_{4}$—$1^{1}/_{4}$″ (P.).
4 Slethvar $^{3}/_{4}$—$1^{1}/_{2}$″ (P.).

Nr. 96. Den 20de Juli med Rejehov i Strandkanten paa Anholt Nordstrand. Sand. Se Nr. 92, 93 og 155.

15 Skrubber $^{3}/_{4}$—1″ (P.).
Smaamasket Vaad gav intet Resultat.

Nr. 97. Den 21de Juli med smaamasket Vaad 2 Kvml. NV. for Anholt Fyrt. i 10 Fv. Sand.

54 Isinger $3^{3}/_{4}$—$9^{1}/_{4}$" { Temp. i Overfl. $19{,}_{9}{}^{0}$, Salth. $1{,}_{64}$ $^{0}/_{0}$. }
1 Kuller $6^{3}/_{4}$" { — ved Bund $13{,}_{8}{}^{0}$, — $3{,}_{00}$ - }

Nr. 98. Den 21de Juli med smaamasket Vaad 5 Kvml. NO. t. N. for Anholt Fyrtaarn i 21 Fv. Slik.

2 Rødspætter $15^{1}/_{4}$—$17^{1}/_{4}$". { Temp. i Overfl. $19{,}_{7}{}^{0}$, Salth. $1{,}_{83}$ $^{0}/_{0}$. }
14 Isinger 4—$9^{3}/_{4}$". { — ved Bund $9{,}_{2}{}^{0}$. — $3{,}_{36}$ - }
107 Haaisinger $3^{3}/_{4}$—$9^{1}/_{4}$", 1 Rokke 10".
5 à 6 *Goniaster*.

Nr. 99. Den 29de Juli. Stranden ved Randsfjord.

8 Skrubber 1—$1^{1}/_{2}$" (H.).
2 Pighvar $1^{1}/_{4}$" (P.).

Nr. 100. Den 4de August med smaamasket Vaad 1 Kvml. Ø. for Gjedser Fyrtaarn i 5 Fv. Sand.

3 Isinger $6^{1}/_{4}$—9" { Temp. i Overfl. 17^{0}, Salth. $0{,}_{78}$ $^{0}/_{0}$. }
4 Ulke. { — ved Bund 16^{0}, — $0{,}_{76}$ - }

Nr. 101. Den 4de August med smaamasket Vaad N. for Rødsand i 3 Fv. Sandbund. Vaaddet fiskede Sten og maatte bjærges.

Nr. 102. Den 4de August med Rejehov paa Ydersiden af Rødsand. Paa Ydersiden fandtes haard Sandbund med Revler, paa Indersiden blødt mudderblandet Sand med Alger.

41 Skrubber 1—$2^{1}/_{2}$" (H.), (heraf dog enkelte indenfor Sandet paa den bløde Bund).

45 Pighvarrer $^{1}/_{2}$—$1^{3}/_{4}$" (P.).

Gobius, *Idothea*, den trepiggede Hundestejl. Smaamasket Vaad gav intet Udbytte.

Nr. 103. Den 4de August med smaamasket Landdragningsvaad rundt om Kroghagepynten og forbi Gjedser Havn. Rullesten i Stranden, Sand længere ude. Daarlige Forhold for Yngel af Fladfisk.

10 Skrubber 3—$10^{3}/_{4}$", Ulke.

Nr. 104. Den 7de August med smaamasket Vaad $11^{1}/_{2}$ Kvml. i S. $^{3}/_{4}$ V. fra Møens Fyrtaarn i $8^{1}/_{2}$ Fv. Fint Sand.

295 Rødspætter 4—$13^{1}/_{2}$".
452 Isinger $3^{1}/_{4}$—$8^{1}/_{4}$".
1 Skrubbe $7^{3}/_{4}$"
1 Torsk $5^{1}/_{2}$", 1 lille Ulk. { Temp. i Overfl. $17{,}_{5}{}^{0}$, Salth. $0{,}_{79}$ $^{0}/_{0}$. }
1 4-traadet Havkvabbe $2^{1}/_{2}$". { — ved Bund $13{,}_{2}{}^{0}$, — $0{,}_{98}$ - }
Muslinger i Klumper og megen Vegetation.

Nr. 105. Den 7de August samme Sted, stormasket Vaad udsat 6 Gange.

82 Rødspætter $5^{1}/_{2}$—$14^{3}/_{4}$" (flest paa $9^{1}/_{2}$—12").
1 Pighvar ♀ $8^{3}/_{4}$", havde leget.
c. 6 Isinger smaa, 1 *Agonus*.
2 Tangspræller 6", *Gobius*.
1 Stenbider $3^{3}/_{4}$".
Megen Vegetation, *Idothea* og Tanglopper.

Nr. 106. Den 7de August med smaamasket Vaad $11,_3$ Kvml. SV. $^3/_4$ S. for Møens Fyrtaarn i 11 Fv. Sandblandet Slik.

97 Rødspætter $3^1/_4$—12″. { Temp. i Overfl. $18,_0{}^0$, Salth. $0,_{87}$ $^0/_0$. }
172 Isinger $2^1/_2$—$8^1/_4$″. { — ved Bund 11^0, — $1,_{78}$ - }
1 Skrubbe $7^1/_2$″, 10 Ulke, 1 *Agonus.*
9 *Lumpenus* 7—$11^3/_4$″.
Faa Søstjærner (*Asterias rubens*).
Megen Vegetation, Musling, *Idothea,* Tanglopper.

Samme Sted gav stormasket Vaad:
4 Rødspætter 10″.
3 Pighvar ♂ $8^1/_4$—$9^1/_2$″, hver med en *Lumpenus* i Munden.
Desuden Vegetation etc.

Nr. 107. Den 7de August. Smaamasket Vaad 13 Kvml. i SV. $^3/_4$ V. for Møens Fyrtaarn i 12 Fv. Slik.

Vaaddet fangede Sten og maatte bjærges.

Nr. 108. Den 8de August med smaamasket Vaad 17 Kvml. SV. for Møens Fyrtaarn i 11 Fv. Sandblandet Slik.

Vaaddet fangede Sten og maatte bjærges.

Nr. 109. Den 8de August med smaamasket Vaad 19 Kvml. SV. $^3/_4$ S. for Møens Fyrtaarn i $9^1/_2$ Fv. Sand.

368 Rødspætter $3^1/_2$—12″ (flest fra $4^1/_1$—$6^1/_4$″), heraf vejede 6 Stk. paa 10″ og derover $3^1/_2$ Pd.

411 Isinger $2^3/_4$—8″. { Temp. i Overfl. 18^0, Salth. $0,_{93}$ $^0/_0$. }
2 Torsk paa $5^3/_4$″. { — ved Bund $10,_5{}^0$ — $1,_{90}$ - }
3 Aalekvabber og 3 *Agonus.*

Et stormasket Vaad samme Sted gav:
6 Rødspætter $10^3/_4$—$13^1/_2$″, 3 Pd.

Nr. 110. Den 9de August med smaamasket Vaad 18 Kvml. S. $^1/_4$ O. fra Møens Fyrtaarn i 10 Fv. Brunt Sand.

594 Rødspætter $4^1/_4$—$11^3/_4$″ (flest mellem 6—9″), heraf vejede 36 Stk. fra 10″ og derover 17 Pd.

487 Isinger $2^1/_2$—$8^3/_4$″. { Temp. i Overfl. 18^0, Salth. $0,_{87}$ $^0/_0$. }
2 Aalekvabber $11^1/_4$″. { — ved Bund 12^0, — $1,_{79}$ - }
2 Torsk $5^3/_4$ og 6″, *Gobius* og Ulke.
I dette Træk fiskedes ialt 1087 Stk. Fisk.

Samme Sted gav et stormasket Vaad:
38 Rødspætter $9^1/_2$—$14^1/_2$″, $18^1/_2$ Pd.
1 Stenbider $7^1/_4$″.
Muslinger i store Klumper, Vegetation.
Ejendommeligt Plancton i Vandets Overflade.

Nr. 111. Den 9de August. Smaamasket Vaad $14^1/_2$ Kvml SO. t. O. $^1/_4$ O. fra Møens Fyrtaarn i 20 Fv. Fint, brunt Sand.

131 Rødspætter $4^{1}/_{4}$—$12^{3}/_{4}$" (flest fra 6—9"), heraf vejede 7 Stk. paa 10" og derover $2^{3}/_{4}$ Pd.

149 Isinger $3^{1}/_{2}$—8".
1 Skrubbe $9^{1}/_{2}$".
Temp. i Overfl. $18,_{8}{}^{0}$, Salth. $0,_{82}$ %.
— ved Bund 12^{0}, — $1,_{10}$ -
5 Ulke og 2 *Agonus*.

Ejendommeligt Plancton i Vandets Overflade.

Et Travltræk samme Sted gav Skaller og Muslinger.

Nr. 112. Den 9de August med smaamasket Vaad 6 Kvml. S. $^{1}/_{4}$ V. for Møens Fyrtaarn i $9^{1}/_{2}$ Fv. Fint Sand.

225 Rødspætter 4—13" (flest 6—9"), heraf 24 Stk. paa 10" og derover. $10^{1}/_{2}$ Pd.

80 Isinger 4—$8^{1}/_{2}$".
4 Skrubber $6^{3}/_{4}$—$8^{1}/_{4}$".
3 Aalekvabber $8^{1}/_{4}$—11".
3 Ulke og 1 Pandserulk.
Temp. i Overfl. $18,_{5}{}^{0}$, Salth. $0,_{88}$ %.
— ved Bund 13^{0}, — $0,_{98}$ -

Vegetation og Musling.

Ejendommeligt Plancton i Overfladen.

Nr. 113. Den 9de August med smaamasket Landdragningsvaad og Rejehov i Strandkanten lige nord for Hesnæs Havn. Sandbund.

Dette er det eneste Sted paa Kysten omkring Hestehoved, hvor Vaaddet kan bruges, da her ellers overalt findes en Mængde baade store og smaa Sten.

1 Rødspætte 2" (P.).
28 Skrubber 3—7".
177 Skrubber $^{1}/_{2}$—$1^{3}/_{4}$" (P.).
11 Pighvar 1—$1^{3}/_{4}$" (P.).

Ejendommeligt Plancton, som strakte sig helt ind i Strandkanten.

Nr. 114. Den 10de August med smaamasket Vaad, trukket til Land, og Rejehov i Strandkanten vest for Klintholm Havn. Sandbund.

38 Skrubber 1—8" (11 under 2", H.).
26 Pighvar $^{1}/_{2}$—$1^{1}/_{2}$" (P.).
2 Slethvar $1^{3}/_{4}$ og 2" (P.).
1 Slethvar 10" ♀ med tom Rognsæk.
1 Tobis.

Nr. 115. Den 10de August med smaamasket Vaad i $3^{1}/_{2}$ Fv. Sand. Udfor Klintholm Havn.

9 Skrubber $2^{3}/_{4}$—$5^{1}/_{2}$".

(Temperatur og Saltholdighed se Nr. 116).

Nr. 116. Den 10de August med smaamasket Vaad i $4^{1}/_{2}$ Fv. Sand. Udfor Klintholm Havn.

2 Rødspætter 4 og $8^{1}/_{2}$".
4 Isinger $5^{1}/_{4}$—$6^{1}/_{4}$".
Temp. i Overfl. $19,_{5}{}^{0}$, Salth. $0,_{84}$ %.
— ved Bund 18^{0}, — $0,_{80}$ -

Nr. 117. Den 10de August med smaamasket Vaad 3 Kvml. SV. $^{3}/_{4}$ S. for Møens Fyrtaarn. 11 Fv. Fint Sand. Fangede Sten paa begge Arme og maatte bjærges.

Nr. 118. Den 11te August med smaamasket Landdragningsvaad og Rejehov udfor Bøtø Nor, Falsters Østside. Sandbund med Revler.

70 Skrubber $1^1/_4$—$13^1/_4$″ (H.).
8 Pighvar $1^1/_4$—$4^1/_2$″ (P.).
11 Pighvar $^1/_2$—1″ (P.).
5 Slethvar 2—$2^1/_2$″ (P.).
1 Aal $4^1/_2$″, 2 Stenbidere $^1/_2$″.
Yngel af *Gasterosteus aculeatus*.
Ejendommeligt Plancton ude fra Søen helt ind til Stranden.

Nr. 119. Den 11te August med smaamasket Vaad $8^3/_4$ Kvml. NV. t. N. $^1/_2$ N. for Daserort Fyrtaarn i $10^3/_4$ Fv Brunt Sand.

77 Rødspætter 4—$11^3/_4$″ (flest fra 4—7″), de 3 største over 10″ vejede ialt $1^1/_4$ Pd.

132 Isinger 3—$8^1/_4$″.
1 Skrubbe $8^3/_4$″.
2 Torsk 6 og 7″.
1 Stenbider $6^1/_2$″.
Nogle Ulke og Pandserulke.
Laminaria.

Temp. i Overfl. $20,_7{}^0$, Salth. $0,_{86}$ $^0/_0$.
— ved Bund $9,_2{}^0$, — $2,_{32}$ -

Gjennemsnitsvægten af 114 Stk. Rødspætter fra Østersøen paa 10″ og derover var $^1/_2$ Pd.

Nr. 120. Den 12te August med smaamasket Vaad paa Tolkegrundene i Grønsund.

1 Skrubbe $6^1/_2$″.
Stærk Strøm forhindrede Vaaddet i at følge Bunden.

Nr. 121. Den 13de August med Rejehov i Rosendals Havn ved Faxe Ladeplads. 1 à 2 Fod Vand.

3 Pighvar $1^1/_2$—$1^3/_4$″ (H.).
1 Skrubbe $1^3/_4$″ (H.).

Nr. 122. Den 14de August med smaamasket Vaad (Landdragning) og Rejehov i Stranden i Søhundehavn. Sand.

24 Skrubber $1^1/_4$—$5^3/_4$″ (H.).
2 Pighvar 1—$1^5/_8$″ (P.).
2 Slethvar $2^1/_4$ og $2^1/_2$″ (P.).

Nr. 123. Den 14de August med smaamasket Vaad udfor Bøgenæs Sand (Søhundehavn) i 2 Fv. Sand.

1 Skrubbe $8^1/_4$″.
4 Aalekvabber.

Temp. i Overfl. $19,_7{}^0$, Salth. $0,_{84}$ $^0/_0$.
— ved Bund $19,_0{}^0$, — $0,_{96}$ -

Nr. 124. Den 14de August med smaamasket Vaad $2^1/_2$ Kvml. syd for Tokosten paa Hollændergrunden, $6^1/_2$ Fv. Sand.

Fangede Sten og maatte bjærges.

Nr. 125. Den 14de August med smaamasket Vaad, 11 Kvml. N. t. Ø. $^1/_2$ Ø., for Møens Pynt, 12 Fv. Fint Sand.

48 Rødspætter ♀ $6^1/_2$—$11^1/_4$″. } Temp. i Overfl. $19,_2^0$, Salth. $0,_{90}$ %.
47 Rødspætter ♂ $4^1/_2$—$10^1/_4$″. } — ved Bund 14^0 — $0,_{99}$ -
188 Isinger.

Nr. 126. Den 15de August med Rejehov og smaamasket Vaad paa Sandet ved Fedet (Præstø). Sandbund — paa 1—6 Fod Vand.

1 Skrubbe $1^3/_4$″ (H.).

Uhyre lidt Udbytte i Forhold til den anvendte Tid og de gode Bundforhold.

Ved Stevns Klint den 15de August:

1 Pighvar $1^1/_4$″ (H.).

Nr. 127. Den 16de August med smaamasket Landdragningsvaad og Rejehov i Stranden ved Kjøge Havn. Haard Sandbund.

2 Rødspætter $3^1/_4$—$3^1/_2$″.
16 Skrubber $2^1/_2$—$5^1/_2$″.
2 Pighvar $1^1/_4$″ (P.).
2 Slethvar $2^1/_2$—$6^3/_4$″.
2 Aborrer $4^1/_4$—$5^1/_4$″.
Gasterosteus aculeatus og *Gobius*.

Men alt i ringe Mængde i Forhold til den Tid, der blev fisket, og de gode Bundforhold for Yngelen.

Nr. 128. Den 19de August med Rejehov i Stranden ved Aalsgaarde (Sjællands Nordkyst).

6 Rødspætter $1^3/_4$—$3^1/_4$″ (H.).
1 Skrubbe $1^3/_4$″ (H.).
2 Pighvar $1^1/_4$—$1^1/_2$″ (H.).
2 Tunger $1^1/_8$—$1^3/_8$″.

Nr. 129. Den 27de August med Rejehov i Stranden neden for Lyngsbæk Skov, Ebeltoft Vig.

2 Rødspætter 3 og $3^1/_4$″.
3 Skrubber $1^1/_4$—2″ (P.).
4 Pighvar $1^1/_4$—$2^1/_2$″ (P.).

Stærkt Højvande, som vanskeliggjorde Vadningen med Rejehov, da selve Strandbæltet kun havde ringe Bredde.

Nr. 130. Den 31te August med Rejehov i Bunden af Kallundborgfjord paa blødt, mudderblandet Sand, 1 à 2 Fod Vand, og foran Udløbet af en lille Bæk.

79 Skrubber $^3/_4$—$5^1/_2$″ (P.).
Hundestejler, *Gobius*, Naalefisk.
Rejer og Yngel af Tangsprælle.

Et Garnsæt udfor Refsnæs i Kallundborg Fjord i 9 Fv. gav:

5 Rødspætter, 1 Torsk.
11 Isinger, 1 Spirhaj.
6 Skrubber, 21 Rokker.
1 Haaising.

Nr. 131. Den 4de September med smaamasket Vaad og Rejehov paa Draget mellem Egholm og Agersø. Sand, og længere inde lerblandet Sand. Fra 1 à 2 Fod til 1 Fv. Vand. Generedes en Del af Sø.

2 Rødspætter $2^{3}/_{4}''$ (P.).
39 Skrubber $1^{1}/_{4}$—$6^{1}/_{4}''$ (H.).
5 Pighvar $^{3}/_{4}$—$1^{3}/_{4}''$ (P.).
1 Tunge $1^{3}/_{4}''$.

Nr. 132. Den 5te September med Rejehov inde i den lille Havn ved Kramnitze, Laaland.

9 Skrubber 1—$1^{3}/_{4}''$ (H.).
1 Pighvar $1^{1}/_{4}''$ (H.)
Stærk Sø udenfor, godt Vejr vilde vel give bedre Resultat.

Nr. 133. Den 5te September med smaamasket Vaad 7 Kvml. S. t. V. for Gjedser Sømærke i 11 Fv. Slik.

25 Rødspætter ♀ $4^{1}/_{4}$—$10^{1}/_{2}''$.
46 Rødspætter ♂ $4^{1}/_{2}$—$8^{1}/_{2}''$.
12 Rødspætter ⚥ 4—$5^{3}/_{4}''$. Temp. i Overfl. $16,_{3}{}^{0}$, Salth. $1,_{03}\,{}^{0}/_{0}$.
309 Isinger $2^{1}/_{4}$—$8^{3}/_{4}''$. — ved Bund $14,_{0}{}^{0}$, — $1,_{89}$ -
2 Pighvar ♀ 9 og ♂ $7^{3}/_{4}''$.
12 *Lumpenus* $5^{1}/_{2}$—$10^{1}/_{4}''$.
1 Aalekvabbe $10^{1}/_{2}''$ og Ulke.

Nr. 134. Den 8de September med smaamasket Landdragningsvaad og Rejehov i Stranden nord for Snogebæk Havn (Bornholm). Haard Sandbund. Se Nr. 79.

121 Skrubber $^{1}/_{2}$—$2^{1}/_{4}''$ (P.).
9 Skrubber $3^{3}/_{4}$—$10''$.
3 Rødspætter 2—$2^{3}/_{4}''$ (P.).
29 Pighvar $1^{1}/_{4}$—$2^{3}/_{4}''$ (P.).
Sildeyngel fra $1^{3}/_{4}$—$3''$.
Tobisyngel.

Nr. 135. Den 8de September med smaamasket Vaad i Bugten nordenfor Snogebæk Havn (Bornholm) i 3 Fv. Sand.

3 Rødspætter $7^{1}/_{4}$—$9^{1}/_{4}''$.
14 Skrubber 5—$8^{3}/_{4}''$.
1 Ising $9^{1}/_{2}''$. Temp. i Overfl. $16,_{7}{}^{0}$, Salth. $0,_{61}\,{}^{0}/_{0}$.
1 Pighvar $9''$. — ved Bund $16,_{4}{}^{0}$, — $0,_{77}$ -

I Garn den næste Dag udfor Snogebæk i 12 Fv., Sten:

3 Pighvar ♀ 9—$13^{1}/_{4}''$ (hel tom Rognsæk) foruden Skrubber og Isinger samt faa Rødspætter og Torsk.

Nr. 136. Den 12te September med smaamasket Vaad 20 Kvml. SO. t. O. for Møens Fyrtaarn. 16 Favne. Fint, brunt Sand.

111 Rødspætter $4^{1}/_{2}$—$14''$ (heraf 14 Stk. over $10''$ paa 7 Pd. ialt).
249 Isinger $3^{3}/_{4}$—$8^{3}/_{4}''$.

1 Skrubbe $8^1/_4$".
6 Torsk $5^1/_4$—$7^1/_2$".
10 Ulke og Pandserulke.

Temp. i Overfl. $15,_5{}^0$, Salth. $0,_{88}\,{}^0/_0$.
— ved Bund $7,_5{}^0$, — $1,_{22}$ -

Nr. 137. Den 12te September med smaamasket Vaad $5^1/_2$ Kvml. O. t. S. for Møens Fyrtaarn i 12 Fv. Fint Sand.

61 Rødspætter $5^3/_4$—12" (heraf 9 paa 3 Pd.).
156 Isinger 3—$8^1/_2$".

Temp. i Overfladen 13^0, Salth. $0,_{85}\,{}^0/_0$.
— ved Bunden $7,_4{}^0$, — $0,_{91}$ -

Nr. 138. Den 15de September med smaamasket Landdragningsvaad og Rejehov indenfor Reersø paa Sydsiden af Draget. Blød Sandbund. 3 à 4 Træk.

122 Skrubber 1—$6^3/_4$" (H.).
2 Rødspætter $3^1/_4$—$3^1/_2$".
10 Pighvar 2—$3^1/_4$.

Nr. 139. Den 16de September med smaamasket Vaad sønden for Endelave i 14 Fv. Slik.

2 Rødspætter $6^1/_2$—$7^3/_4$".
433 Isinger $2^1/_4$—$9^1/_4$".
81 Haaisinger $4^1/_2$—13".
3 Torsk $3^1/_4$—$3^3/_4$".
1 Hvilling $5^1/_4$".

1 *Lumpenus* $7^1/_2$", desuden Ulke og Pandserulke, Kutlinger, Rejer, Søstjærner, Sømus, en Mængde gamle Rokkeægkapsler., død Vegetation.

Temp. i Overfladen $15,_0{}^0$, Salth. $2,_{43}\,{}^0/_0$.
— ved Bunden $13,_0{}^0$, — $2,_{91}$ -

Nr. 140. Den 18de September med smaamasket Landdragningsvaad og Rejehov paa Stranden nord for Grenaa Havn. Sandbund, enkelte Steder kalkholdig. 2 Træk. Se Nr. 95.

8 Rødspætter 2—$5^3/_4$".
11 Skrubber $6^1/_4$—$8^3/_4$".
3 Ising 8—10".
3 Pighvar $2^1/_4$—$4^1/_4$".
3 Slethvar 4—$11^3/_4$". (den største en ♂).
1 Fjæsing 12".

Nr. 141. Den 19de September smaamasket Vaad trukket til Land nord for Sæby Havn paa Stranden.

Vaaddet fyldtes strax af en Mængde Vandmænd (*Cyanea capillata*) og Tobisyngel.

Nr. 142. Den 20de September med Rejehov i Bækken ved Bangsbostrand. Se Nr. 70, 88, 91, 143 og 162.

222 Skrubber 1—$1^7/_8$" (H.).

Nr. 143. Den 21de September med Tobisvaad, trukket til Land, og Rejehov. Stranden ved Bangsbostrand, c. 5 Træk. Se Nr. 70, 88, 91, 142 og 162.

19 Rødspætter $4^{1}/_{2}$—$7^{1}/_{4}$″.
265 Rødspætter $1^{1}/_{2}$—3″ (P.).
19 Skrubber 1—$7^{1}/_{4}$″ (H.).
14 Pighvar $1^{3}/_{4}$—$3^{3}/_{4}$″ (P.).
4 Slethvar 2—3″.
5 Tunger $1^{1}/_{2}$—2″.
3 Hvillinger $3^{1}/_{4}$—$5^{1}/_{4}$″.
73 Tobis $2^{1}/_{4}$—$2^{3}/_{4}$″.
5 Sild $1^{3}/_{4}$—$4^{1}/_{2}$″.
2 Naalefisk 4 og $4^{1}/_{2}$″.
1 Aalekvabbe 5″.
3 Tangsnarer $4^{1}/_{4}$—6″ samt *Gobius* og forskjellige *Crustaceer*.

Nr. 144. Den 22de September med Tobisvaad i Frederikshavns inderste Havn i $3^{1}/_{2}$ Fv. Mudder.

29 Rødspætter $3^{1}/_{4}$—9″.
1 Skrubbe 2″.
1 Ising $6^{3}/_{4}$″.
2 Tunger 3″.
4 Hvillinger $4^{3}/_{4}$—$7^{1}/_{4}$″, Aalekvabber og *Gobius*.

Nr. 145. Den 25de September med Tobisvaad i Stranden ved Nykjøbing S. 1 à 2 Fod Vand.

1 Skrubbe $1^{3}/_{4}$″ (H.).
Naalefisk og *Gobius*.

Nr. 146. Den 26de September med Tobisvaad $2^{1}/_{2}$ Kvml. nord for Kongsøre Nakke i $4^{1}/_{2}$ Fv. Mudder.

Ingen Fladfisk. Søstjærner, Søpunge, Slangestjærner, Rejer, *Gobius*, derimellem Yngel af *Aphya pellucida*.

Nr. 147. Den 26de September med Tobisvaad lidt Norden for Søminestationen i Inderbredningen. $4^{1}/_{2}$ Fv. Mudder.

Ingen Fladfisk. Aalekvabber, *Gobius*, Søstjærner og Naalefisk.

De to sidste Træk foretoges dels for at se, hvorledes Tobisvaad arbejdede paa Mudderbund, dels for mulig at finde den lille Tunge.

Nr. 148. Den 27de September med Tobisvaad og Rejehov paa Sandet indenfor Hundested Havn og langs Havnemolerne.

61 Rødspætter $2^{1}/_{4}$—$4^{1}/_{4}$″.
4 Skrubber $2^{1}/_{4}$—3″.
1 Ising $7^{1}/_{2}$″.
35 Pighvar $1^{1}/_{4}$—$3^{3}/_{4}$″ (P.).
4 Slethvar $2^{1}/_{4}$—$3^{3}/_{4}$″.
1 Hundestejl (*Gasterosteus aculeatus*), *Gobius*.
266 Tobis 2—$5^{1}/_{2}$″.
Med Vaaddet gjordes 4 Træk. Vandets Temperatur 12°.

Nr. 149. Den 28de September i Stranden ved Hornbæk med Tobisvaad (Landdragning) og Rejehov. 1 Træk.
54 Rødspætter $2^1/_4$—$3^3/_4$".
3 Skrubber $5^1/_2$—$5^3/_4$".
15 Pighvar $1^1/_2$—$3^3/_4$" (P.).
ca. 150 Sild $^3/_4$—$1^1/_2$".
60 Tobis 2—$2^3/_4$".
1 Ulk og 1 *Agonus*. Vandets Temperatur 11°.

Nr. 150. Den 3die Oktober. Tobisvaad ved Knæhagen, Rå. $15^1/_2$ Fv. Slik. 5 à 10 Pund sattes paa Vaaddets Arme. Vaaddet gik godt.
Gobius (Aphya), Søpindsvin, Slangestjærner, *Mytilus edulis* og Kammuslinger.
Vegetation *Chorda filum* (*Zostera* og *Fucus vesiculosus* drivende i Vandet).

Nr. 151. Den 3die Oktober med Tobisvaad (Landdragning) paa Nordsiden af Kronborg Pynten. Sand. 2 Træk.
23 Rødspætter 2—4".
2 Skrubber 4—$5^1/_4$".
1 Tunge $1^7/_8$".
200 Tobis $2^1/_4$—$3^3/_4$".
1 Sild $2^1/_2$". Vandets Temp. 14°.
Tobisvaad i 4 Favne udfor Pynten, skar ned i Sandet.

Nr. 152. Den 3die Oktober med Tobisvaad (Landdragning) og Rejehov paa Stranden ved Hellebæk. Sand. 2 Træk over samme Areal.
57 Rødspætter $1^1/_2$—4" (H.).
23 Skrubber $1^1/_4$—$11^1/_4$" (H.).
93 Pighvar 1—$3^3/_4$" (P.).
Vandets Temperatur 14°.

Nr. 153. Den 5te Oktober med Tobisvaad (Landdragning) i Stranden ved Gilleleje. 2 Træk. Se Nr. 90.
22 Rødspætter $2^1/_4$—$3^3/_4$".
4 Skrubber $1^1/_4$—6" (H.).
1 Ising $7^1/_4$".
3 Pighvar $1^3/_4$—4" (P.).
2 Tobis $5^3/_4$—9", en Mængde Sildeyngel.
1 Læbefisk c. 2".
Gobius Ruthensparri. Vandets Temperatur 11°.

Nr. 154. Den 5te Oktober med smaamasket Vaad $1^1/_2$ Kvml. Norden for Anholt Fyrt. i 8 Fv.
1 Rødspætte $12^1/_2$".
49 Isinger $4^3/_4$—$10^3/_4$".
2 Søkarudser, 1 Rokke, *Gobius*.
Temperatur i Overfladen $12{,}_3{}^0$, Salth. $2{,}_{51}$ $^0/_0$.
— ved Bunden $11{,}_8{}^0$, — $2{,}_{57}$ -
Tobisvaad samme Sted gav: *Gobius Ruthensparri* — ingen Fladfisk.

Nr. 155. Den 6te Oktober med Tobisvaad (Landdragning) og Rejehov i Stranden paa Anholt Nordstrand. Sand. 2 Træk. Se: 92, 93, 96.

25 Rødspætter $1^1/_2$—$4^1/_2$″ (H.).
10 Skrubber $1^1/_2$—$2^1/_2$″ (H.).
36 Pighvar $1^1/_4$—$3^1/_4$″ (P.).
1 Slethvar $3^1/_4$″. Vandets Temp. 12°.

Nr. 156. Den 6te Oktober med smaamasket Vaad, Anholt Nordstrand i 3 Fv. Sand.

156 Isinger $6^1/_4$—11″.

Nr. 157. Den 6te Oktober med smaamasket Vaad $3^1/_2$ Kvml. NV. for Anholt Fyrt. i 8 Fv. Sand.

6 Rødspætter 12—13″ (5 Pd.).
446 Isinger $3^3/_4$—$13^1/_2$″.
1 Haaising $11^1/_2$″.

1 Torsk $9^1/_2$″, 1 Rokke, 1 Knurhane. Søstjærner, Søpunge, Eremitkrebs, død *Furcellaria*.

Temperatur i Overfladen $12_{,5}^{0}$, Salth. $2_{,51}$ $^0/_0$.
— ved Bunden $11_{,6}^{0}$, — $2_{,63}$ -

Nr. 158. Den 13de Oktober. Smaamasket Vaad udfor Søby Havn, Ærø. 6 Favne. Mudder.

5 Rødspætter 10—$12^3/_4$″.
22 Isinger $3^1/_4$—$9^3/_4$″.
5 Haaisinger $10^1/_4$—12″.

Nr. 159. Den 13de Oktober. Tobisvaad 3 Kvml. OSO. for Skjoldnæs, Ærø i 15 Fv. Mudder.

14 Isinger $^1/_2$—$1^1/_4$″, nogle *Cumaceer*.

Temperatur i Overfladen $12_{,0}^{0}$, Salth. $1_{,50}$ $^0/_0$.
— paa Bunden $10_{,8}^{0}$, — $1_{,72}$ -

Nr. 160. Den 19de Oktober. Tobisvaad (2 Træk) i Frederikshavns inderste Havn. Mudder.

4 Rødspætter 4—$10^1/_4$″.
5 Skrubber 10—$11^1/_2$″.
2 Isinger $6^1/_2$ og $7^1/_2$″.
3 Hvillinger 5—$5^1/_4$″, nogle smaa *Gobius Ruthensparri*.

Nr. 161. Den 18de Oktober. Tobisvaad paa Aalborgbugten. $6^1/_2$ Fv. Fint Sand. Gav ingen Fladfisk. Det havde gaaet i Bund, thi der fandtes Søstjærner, Søpindsvin og Krabber i Vaaddet.

Nr. 162. Den 19de Oktober med Tobisvaad (Landdragning) i Strandkanten ved Bangsbostrand. Sand. 2 Træk. Se Nr. 70, 88, 91, 142 og 143.

24 Rødspætter $1^3/_4$—$5^1/_4$″ (P.).
58 Skrubber $^3/_4$—$5^1/_2$″ (P.).
6 Pighvar $1^3/_4$—$3^1/_2$″ (P.).
19 Aal $2^1/_2$—$4^1/_2$″ med Rejehov oppe i Bækken.

Nr. 163. Den 23de Oktober. Smaamasket Vaad udfor Skagens By i 3 Favne. Sand.

4 Rødspætter 6—12″.

11 Isinger 4—7″.

1 Torsk.

— I Tobisvaad kun nogle *Aphya pellucida.*

Nr. 164. Den 25de Oktober med Tobisvaad i Frederikshavns inderste Havn, samme Sted som Nr. 144, men fandt ingen Fladfisk.

3 Hvillinger, *Gobius* og nogle *Crustaceer.*

Nr. 165. Den 27de Oktober. Tobisvaad (med Vægt paa Vaaddet) lidt øst for Hirtsholmene. 15 Fv. Slik. Stærk Strøm. Se Nr. 57.

Ingen Fladfisk. Søstjærner, Søpunge, *Crustaceer* og Skaller.

Nr. 166. Den 6te November. Tobisvaad, 6 Kvml. Ø. for Gjedser Fyrskib i 8 Fv. Grovt Sand.

Ingen Fladfisk, 2 *Gobius Ruthensparri.*

Et stormasket Vaad samme Sted gav:

8 Rødspætter 9—12″, 3 Pd.

2 Ising 8—9″.

1 Pighvar ♀ $10^3/_4$″.

Vegetation: *Zostera, Laminaria, Fucus vesiculosus.*

Undersøgelser i 1893 fra den biologiske Station og dens Sejlbaad „Makrelen“.

Nr. 167. SO. for Møllegrunden i Kjertemindebugten, Hverringe lige fri af Skoven. 21. April. C. 10 Favne. 2 Træk med stormasket Snurrevaad.

C. 130 Rødspætter, Isinger, faa Haaisinger, en Skrubbe med moden Rogn, Rokker.

Nr. 168. Samme Sted og Dato. Smaamasket Snurrevaad. Mislykket paa Grund af at Baaden drev for Kuling og Sø.

Nr. 169. Ø. for Kjerteminde Havn. 2—3 Favne Vand. 22. April. Smaamasket Snurrevaad.

5 Ulke, c. 6 smaa Skrubber, Rødspætter fra ca. $3^1/_2$ Tomme og opefter.

Rødspætterne havde *Tellina baltica*, Smaasnegle, *Arenicola marina* i Maven.

Nr. 170. Samme Sted og Dato. Smaamasket Snurrevaad. Gav blandt andet endnu flere Rødspætter.

Nr. 171. Længere ude paa 7 Favne med Dyndbund, hvor Fiskernes Garn staa. Samme Dato. Smaamasket Snurrevaad.

Mange Isinger af 2den og 3die Aargang, 3 Rødspætter, 2 Aalekvabber, 2 Ulke.

Nr. 172. Et Træk øst for Møllegrunden. Samme Dato. 7 Favne. Smaamasket Snurrevaad.

Mange Isinger af 2den og 3die Aargang og nogle af 1ste. Rødspætter større end de foregaaende.

Nr. 173. Syd for Bøgebjærg (paa Hindsholm). 24. April. 2—3 Favne. Sand med Tangpletter. Smaamasket Snurrevaad.

Mislykket paa Grund af Sten, gav dog 1 Torsk, *Spinachia*, *Gob. Ruthensparri*.

Nr. 174. Lidt længere mod Syd. 24. April. Sandrevlerne noget bredere. Smaamasket Snurrevaad.

1 stor Rødspætte, en Ising.

Her er altsaa paa disse Kyster til denne Aarstid aldeles ingen spæd Yngel af Flynderfisk.

Nr. 175. Pughavn paa Fynshoved. 27. April.

Det lave Vand undersøgtes paa forskjellig Maade; men kun ved Vadning saas ganske enkelte mindre Flynderfisk løbe paa Bunden; de hidrørte ikke fra dette Aars Yngel.

Nr. 176. SO. for Romsø. 14 Favne. 2 Mai. Stormasket Snurrevaad.

2 Rødspætter, nogle Skrubber, Isinger, Haaisinger og Smaarokker.

Bunden dækket af gamle, stinkende *Zostera*-Blade og *Fucus*. — *Eupagurer* i *Fusus*- og *Buccinum*-Skaller, store *Spongier* og *Actinier* paa *Fusus* og *Buccinum, Ophioglypha, Echinus Dröbakiensis* o. s. v.

Ved Overfladen	var	Temperaturen	7° C.	Vægtfylden	$1_{,0100}$.
- 3 Favne	-	—	7° -	—	$1_{,0100}$.
- 7 —	-	—	$5_{,5}$° -	—	$1_{,0165}$.
- 14 —	-	—	$3_{,6}$° -	—	$1_{,0225}$.

Ved at gjøre lodrette Træk med en tæt pelagisk Pose, forsynet med et tæt Filter af Møllergace (Hensens Konstruktion), fandtes mellem Overfladen og 5 Favne hverken Fiskeæg eller Smaagopler, overhovedet meget lidt Plancton; fra 6 Favne til Overfladen fandtes i et Træk 2 Æg; fra Vandet lavere nede, 7—14 Favne, fandtes derimod saavel *Sarsia tubulosa* som Fiskeæg i hvert Træk, oftest 11—12 Æg ad Gangen, men *Sarsierne* forhindrede en nøjagtig Tælling.

Jeg fik det Indtryk, at *Sarsierne* og Fiskeægene fandtes i Mængde i det stærkt saltholdige Vand under c. 7 Favne, og manglede ganske i de øverste 5 Favne.

En saadan Udbredelse af to forskjellige Vandmasser har jeg meget ofte havt Lejlighed til at iagttage i Store-Bælt, særlig med sønden Vande. Vandmassernes Bevægelsesretning er ganske modsat, den ene (den øverste) gaar mod Nord, den anden mod Syd.

Nr. 177. Lidt længere syd paa. 2. Mai. 10 Favne. Stormasket Snurrevaad.

20 Rødspætter, mange Isinger, Haaisinger, *Raja sp.*

Noget mindre raadden Bund med *Alcyonidium*, og flere Alger.

Nr. 178. Samme Sted og Dato. Smaamasket Snurrevaad.

Det samme som før, desuden smaa Isinger ned til $1^1/_2$"; og en *Solaster papposus*.

Nr. 179. Udfor Lundsgaard-Klinten. 4. Mai. 7 Favne Vand. Mislykkedes paa Grund af Sten.

Nr. 180. En af Kjerteminde Møller fri af Lundsgaards Klint, og Nyborg Kirke fri af nogle høje Piletræer. 4. Mai. 9 Favne. Stormasket Snurrevaad. Dyndbund uden raadne Planterester.

41 Rødspætter, faa Isinger, faa Haaisinger.

Nr. 181. Et Træk ind mod Kjerteminde paa samme Plads og samme Dato gav Hold i store Sten.

Nr. 182. Paa det Sted, hvor Fiskerne fra Strandhuse sætte Rødspættegarn (Kjertemindebugten). 8. Mai. 9 Favne. Sand og Ler. Stormasket Snurrevaad, 100 Favne Line.

30 Rødspætter, 2 Isinger, 1 Skrubbe, mange *Asterias rubens*. Meget lidt af raadne Planterester.

Nr. 183. Samme Sted og Dato. Stormasket Snurrevaad med 200 Favne Line.

113 Rødspætter, en Del Isinger, nogle Rokker, *Eupagurer*, *Asterias* og en Del løse Alger.

Lidt længere ude i Bæltet med Sprogø i S. til O. og 14 Favne Vand.

Temp. i Overfladen 9^0 C. Vægtfylden i Overfladen $1,_{010}$.

Paa 14 Favne — ved Bunden $4,_4^0$ - — ved Bunden $1,_{020}$.

Med pelagisk Net fandtes i de øverste 8—10 Favne kun smaa *Crustaceer*, ved Bunden derimod desuden *Sarsia* og Fiskeæg.

Nr. 184. 10. Mai. Dalbybugten med Tobisvaad paa Sandet.

1 lille Tobis, 3 etaarige Rødspætter, faa etaarige Skrubber, *Mysis* i Mængde.

Nr. 185. 16. Mai. Fynshoveds Vestside. 9 Favne. Stormasket Snurrevaad.

Mange døde Planter og en Del Isinger.

Nr. 186. 16. Mai. Ved Revet paa Fynshoved. 2 Favne. Ren Sandbund. Smaamasket Snurrevaad.

En Del større Rødspætter og nogle etaarige; nogle Isinger, 1 Slethvar, 2 Skrubber.

Nr. 187. 16. Mai. Udfor Langeklint. $1^1/_2$ Favn. Rent Sand. Stormasket Snurrevaad 200 Favne Line.

C. 20 Rødspætter, 2 Slethvarrer, flere Skrubber, faa Isinger.

Nr. 188. 16. Mai. Udfor Snave Rønner. 8 Fv. Stormasket Snurrevaad. 100 Fv. Line. 2 Isinger og mange mest løse Alger.

Nr. 189. 20. Mai Udfor Bøgebjærg paa Fynshoved.

Temperaturen var ved Overfladen . . $10,_2^0$ C. Vægtfylde ved Overfladen $1,_{014}$.

— paa 7 Favne ved Bunden $6,_7^0$ - — ved 7 Favne $1,_{018}$.

Paa dybere Vand fangedes i pelagisk Net *Sarsier*, andre Smaagopler, 1 Fiskeunge, *Copepoder*; ved Overfladen fangedes ingen Gopler.

Samme Dag i Reje- og Aaleruser i Pughavn (Fynshoved):

20 Aal, mange Aalekvabber og Ulke, Skrubber, faa *Gobius niger*, en Hundestejl, 1 Reje.

Nr. 190. 29. Mai. I Ruserne i Pughavn en Mængde Skrubber og 2den Aargang rigt repræsenteret, den plejer ellers at være sjælden.

Nr. 191. 3. Juni. I et Bæk-Udløb ved Lundeborg Nord for Havnen. Tobisvaad. Ganske lavt Vand.

1 Rødspætte? en Tomme lang, faa en- og to-aarige Skrubber, Aalekvabber, *Syngnather*, *Gobius minutus* og *niger*, *Spinachia*, *Carcinus maenas*, *Palæmon*, *Crangon* i Mængde, *Mysis flexuosa*, *Littorina*, *Cardium edule*.

Nr. 192. 8. Juni. Atter Forsøg paa at finde Rødspættens Yngel fra iaar i Pughavn, saavel med smaamasket Snurrevaad ved Vadning som med Rejehov, men fandt endnu ingen.

Nr. 193. 12. Juni. Udfor Kjerteminde.

Temperatur i Overfladen	$15,_{5}^{0}$ C.	Vægtfylden i Overfladen	$1,_{009}$.
— ved 5 Favne	12^{0} -	— ved 5 Favne	$1,_{015}$.
— - 7 —	10^{0} -	— - 10 —	$1,_{018}$.
— - 12 —	$7,_{5}^{0}$ -	— - 12 —	$1,_{020}$.

Pelagisk i Overfladen og ned til c. 4 Favne (Sønden Vande) *Copepoder*, *Cladocerer*, 1 *Gobius?* Unge.

Pelagisk paa 10 Favne (Norden Vande) en Mængde *Sarsier*, *Thaumantias*, *Bolina* og *Pleurobrachia*, en *Aurelia*, samt Fiskeæg og Fiskeunger.

Nr. 194. 14. Juni. Udfor Havnen ved Kjerteminde paa ren Sandbund. Tobisvaad (brugt som Snurrevaad).

Yngel af Tobiser *Syngnather*, *Spinachier*, 1 stor Ising, 1 *Gobius minutus*, *Mysider*.

Smaamasket Snurrevaad.

En- og to-aarige Rødspætter, 3 Isinger, 1 Skrubbe, 1 Slethvarre, 2 Ulke, *Carcinus mænas* med Æg paa Halen.

Stormasket Snurrevaad.

2 Rødspætter, nogle Skrubber og 1 Slethvar.

Nr. 195. 14. Juni. Ude paa Kjertemindebugten, hvor der før var Rødspætter paa 9 Favne, fandtes nu kun enkelte, desuden Isinger, Haaisinger, 1 Skrubbe, 1 Han-*Cyclopterus*, en *Lumpenus* saas undslippe.

Mange løsrevne Alger og død *Zostera* i Vaaddet.

Nr. 196. 15. Juni. Syd for den røde Tønde ved Romsø. 10 Favne. Stormasket Snurrevaad.

Posen uklar, men der fangedes dog en Del Isinger, Haaisinger, nogle Rødspætter, Rokker, 2 meget store Svampe, *Echinus Dröbakiensis*, 5 *Solaster papposus*.

Bunden var mudderagtig med gammel *Zostera* og løse Alger.

Nr. 197. 15. Juni. Øst for den røde Tønde ved Romsø. 13 Favne. Stormasket Snurrevaad.

Haaisinger, Isinger, 3 Rødspætter, Rokker, 1 *Agonus*.

Ren Bund uden raadden Tang, med *Solaster papposus*, *Echinus Dröbakiensis*, *Pagurer*, *Fusus*, *Ophioglypha*.

Ribbegopler *(Bolina)* følger altid iturevne op med.

Nr. 198. 15. Juni. Længere ude i SO. paa 13 Favne. Stormasket Snurrevaad. En Del løse Alger og død *Zostera*.

2 Rødspætter, Isinger, Haaisinger, Rokker, 1 *Agonus*, 1 Svamp, *Solaster*, 1 *Cribrella*, store *Asterias rubens*, *Fusus*, *Ophioglypha texturata* og *albida*, *Ophiopholis aculeata*, *E. Dröbakiensis*.

Bolina fulgte med Vaad og Ankertoug op.

Nr. 199. 15. Juni. SO. for Romsø. Bøgebjærg til Romsø. 16 Favne. Stormasket Snurrevaad.

Død *Zostera*, Bunden stinkende mudderagtig.

Faa Fisk: Enkelte Rødspætter, Isinger, Haaisinger, Rokker, *Solaster*, *Amphidetus cordatus*.

Paa hele denne Bredning udfor Romsø i Store-Bælt aabenbart smaat med Rødspætter; Bunden i det mindste pletvis stinkende.

Her fiskes af Fiskere aldrig med Redskaber, der fange ved Bunden, men kun med Drivgarn efter Sild i Overfladen. Ganske enkelte Steder ved Kysten sættes Rødspættegarn. Først i Bændeltangens Bælte, d. v. s. fra 0 til c. 6 (7) Favne Vand fiskes der til Stadighed ved Bunden og med godt Udbytte.

Nr. 200. 24. Juni. Paa en lille Sandplet ved Havnehagens Nordende (overfor Kyholm paa Samsø) fangedes med Rejehov 16 smaa Rødspætter og 2 Skrubber, alle af dette Aars Yngel; flere kunde ikke fanges der, og passende Sandbund, hvor saadan Yngel kunde antages at leve, kunde ikke opspores i Nærheden.

Nr. 201. 18. Juli. Baaringvig. 6 Favne.

Tobisvaad, der syntes at have gaaet saavel paa ren Mudderbund som paa Tangbund (*Zostera*). En enkelt *Laminaria* og nogen *Zostera* kom med op. Vaaddet sprængtes delvis af Dynd.

Isinger af 1ste, 2den og 3die Aargang, Rødspætter fra $4^1/_4$—8", enkelte Skrubber, 1 Haaising, c. 20 Torskeunger fra iaar, 3 *Lumpenus*, *Gobius minutus*, *Gunellus*, 1 *Spinachia*-Unge.

Nr. 202. 19. Juli. Ved Østenden af Helnæs (Fyn). Tobisvaad, Vadning.

En Mængde Skrubber fra iaar, 1 Rødspætte, desuden *Gobius minutus* o. s. v.

Nr. 203. 20. Juli. Ved Ristinge-Løb. Tobisvaad. Vadning.

En Mængde smaa Skrubber o. a.

Nr. 204. 26. Juli. Ved Gisseløre (Kallundborg). Tobisvaad. Vadning.

Yngel af Slethvarre, Rødspætter, Skrubber og Tobiser. Alt i ringe Mængde.

Nr. 205. 27. Juli. Havnemark (Kallundborgfjord). Tobisvaad. Vadning.

En Slethvarre $7^3/_4$". En Rødspætte $5^1/_4$". En Skrubbe $4^1/_4$" og desdesuden Yngel fra iaar af Pig- og Slethvarre, Rødspætte og Skrubbe.

Nr. 206. 27. Juli. Pughavn. Tobisvaad.

Yngel fra iaar af Pig- og Slethvarre, Rødspætte og Skrubbe, desuden enkelte Skrubber fra ifjor.

Nr. 207. I Dalbybugten. Tobisvaad.

Yngel af Pig- og Slethvarre. 4 Rødspætter fra iaar, mange Skrubber fra iaar; desuden *Gobius*, Tobiser, *Mysider*, *Crangon*, *Gammarider* etc. Alt fisket paa lavt Vand med ren Sandbund.

Nr. 208. 3. August. Paa Tolkene (Grønsund). 8 Fod Vand. Tobisvaad.
2 Rødspætter paa 5 og 10''.

Nr. 209. 3. August. Ved Fyrene (Tolkene). Paa Sand og Sten med Rejehov.
1 Skrubbe paa $1^{1}/_{2}''$, *Gobius minutus*, *Mysider* i Mængde.

Et Forsøg i Tolkedybet mislykkedes, Vaaddet kunde ikke følge Bunden for Strøm.

Nr. 210. 4. August. Ved Dyrefodsflakket. 3 lange Træk med Tobisvaad paa Sand, der dog var noget bevoxet.
8 smaa Skrubber fra $2^{1}/_{2}$—$4^{1}/_{2}''$. *Gobius*, Hundestejler og *Mysis*.

Nr. 211. 9. August. Rødsand. Tobisvaad. Paa rent Sand.
C. 10 Skrubber fra iaar, enkelte Pighvar fra iaar, *Gobius minutus* i Mængde, *Spinachia*-Yngel, *Syngnather*, Hundestejler, en Sildeunge, Tobiser etc.

Nr. 212. 12. August. Vestsiden af Skalø. Tobisvaad. Vadning. Sand og Tang i Pletter.
C. 20 smaa Pighvarrer fra 1—3'', 6—7 Skrubber fra iaar, 3 fra ifjor, *Gobius microps, minutus* og *niger?*, *Syngnather*, Hundestejler, en Aalekvabbe, *Crangon*, *Idothea*.

Nr. 213. 17. August. Pughavn. Tobisvaad.
8 Skrubber fra ifjor fra $4^{1}/_{2}$—6'', desuden en Mængde fra iaar, 2 Rødspætter fra iaar. Ellers ingen Fladfisk.

Nr. 214. 18. August. Ved Revet (Fynshoved). $1^{1}/_{2}$—2 Favne Vand. Ren Sand. Tobisvaad.
1 Ising, faa *Gobius*, **28 Pund** *Mysis*.

Nr. 215. 21. August. Baaringvig. Paa den østlige Strand. Tobisvaad. Vadning. Sand.
Skrubber i Mængde fra iaar, 1 fra ifjor, 2—3 Rødspætter fra iaar, 1 fra ifjor, c. 20 Pig- og Slethvar fra iaar, 2 Tunger (*Solea vulgaris*) paa $^{3}/_{4}$ og 1'', 2 Tobiser, Naalefisk, *Gobius minutus*, Krabber, *Crangon* i Mængde, *Cardium edule* Yngel i Mængde og anden Musling-Yngel.

Nr. 216. 21. August. Midt i Baaringvig. 2 Træk med Tobisvaad. 7 Favne.
Smaa Aalekvabber, *Gobius minutus*, 3 smaa Isinger, 2 spæde Sildeunger, 1 *Corymorpha*, Smaastumper af brun *Zostera*.

Nr. 217. 22. August. Espenhoved, Fænø. 6 Træk med Tobisvaad. Vadning
9 Pighvarrer, en Del Skrubber mellem $1^{1}/_{2}$ og $3^{3}/_{4}''$, *Gobius minutus*, ingen Rødspætter.

Nr. 218. 28. August. Ved den røde Tønde. Romsø. 11 Favne. Tobisvaad.
Isinger af 2 Aargange, 1 Haaising samt Kutlingeunger. Af Isinger fra iaar saas ingen.

I det dybe Vand var der nu ingen Fiskeæg eller *Sarsier* mere, derimod *Appendicularier*.

Nr. 219. 4. September. Nord for Kjerteminde Havn. Smaamasket Snurrevaad. 100 Fv. Line. Rent Sand.

2 Snese Rødspætter fra iaar, en Del Skrubber, en større Slethvar.

Nr. 220. Samme Sted og Dato etc.

2 Snese Rødspætter fra iaar, én fra ifjor, nogle Skrubber fra ifjor, 5 Slethvar, 1 Pighvar, 3 Ulke.

Nr. 221. Samme Sted og Dato etc.

25 Rødspætter fra iaar, nogle Skrubber, 3 Slethvar.

Nr. 222. Samme Sted og Dato etc. Tobisvaad. 100 Fv. Line.

2 Rødspætter, 6 Skrubber, c. 16 Pund *Mysider* og enkelte Kutlinger.

Undersøgelser fra selve den biologiske Station i Kjertemindes umiddelbare Nærhed.

Nr. 223. 4. April. Pelagiske Fiskeæg af Rødspætter, Torsk, Skrubber? Haaising?

Paa Sandrevlerne fandtes ganske enkelte Rødspætter (ingen fra iaar).

Nr. 224. 5te April. Større Mængde af Flynderfisk undersøgt.

Rødspætter næsten færdige med Legen.

Skrubber i fuld Leg.

Isinger endnu ej legende.

En Haaising, moden, løbende Rogn.

Af Hanner fandtes meget faa blandt disse sidstnævnte, der alle ere fangede paa lavt Vand og Tangbund. Legepladserne ere aabenbart paa dybere Vand.

Vandets Vægtfylde er i Dag sunken ned til c. $1_{,013}$ mod $1_{,0185}$ i Gaar. Alle Ægene i Vandet i Dag forsvundne.

Paa Bunden paa Sandet fiskedes med pelagisk Pose og her fandtes nogle Æg, i et langt Træk, 10—15 Stk., de fleste vare fordærvede. I Dammen saas mange Unger af *Gunellus*, *Cottus* og enkelte *Agonus*.

Det viste sig i Sommerens Løb, at pelagiske Æg kun sjelden kunde flyde i selve Kystvandet i større Mængde.

Med stormasket Snurrevaad paa Kjertemindebugten fangedes c. 30 Rødspætter, en Del Skrubber, Isinger og Haaisinger. De modne Fisk (Skrubber) fandtes længst mod Øst paa det dybeste Vand.

Nr. 225. 6. April. Fisket med forskjellige Redskaber efter Flynderfisk, særlig paa lavt Vand, men kun ganske faa (2) etaarige Rødspætter og enkelte 2aarige fanges.

Nr. 226. 22. April. Smaamasket Snurrevaad paa Sandet ved Havnen gav nogle faa etaarige Rødspætter og flere større. Paa Dyndbund fandtes kun større Rødspætter. Enkelte mindre Skrubber fangedes, men flest legende udvoxede. Paa Sandet fangedes kun 1 Ising, paa Dyndbund mange, men ingen (maaske 2) etaarige. Unge Rødspætter og Isinger paa et Aar synes derfor sjældne her.

Nr. 227. 24. April. En Rødtunge (*Pleur. microcephalus*) leveredes af Fiskerne som en Sjældenhed. Her er endnu ingen Flynderfisk til Rejehov paa Revlerne.

Nr. 228. 25. April. I Noret. Søgt efter smaa Fladfisk med smaamasket Snurrevaad, men kun 3 à 4 mindre Skrubber (fra ifjor) fangedes. Mon de større Skrubber holde sig til Mudder- og *Zostera*-Bunden her i Fjorden, hvor de ere vanskelige at tage med disse Vaad? En Del Baade fiskede i Noret med Agnvaad efter *Gobius niger* til Aalekrogene, de fangede ingen Fladfisk, men Hundestejler, Aalekvabber, Kutlinger, Naalefisk, Rejer o. s. v.

En særdeles stor Mængde *Aurelia*-Yngel fandtes overalt i Noret, de udvikles aabenbart herinde.

Nr. 229. 3. Mai. I Ruser i Noret, *Spinachia* i Mængde, *Gobius niger,* Ulke, Aalekvabber, Aal, Krabber, ingen Rejer endnu.

Nr. 230. 12. Mai. I Ruserne i Noret flere gule Aal, Skrubber, 3 Rødspætter (smaa fede), *Spinachia,* 4 fede Torsk (Kutlinger i Maven) o. s. v.

Nr. 231. 1. Juni. Tobisvaad ved Havnen. Aarets Yngel af Rødspætter og Skrubber fandtes i mindre Mængde fra 8 indtil c. 30 mm. Længde. I deres Maver fandtes: *Copepoder, Cladocerer, Ostracoder,* Muslingelarver. Hos de samtidig fangede, etaarige Rødspætter fandtes hovedsagelig Annelider.

Nr. 232. 7. Juni. Taget 19 Rødspætte-Unger paa Sandrevlerne fra $^1/_2$ til $1^1/_6$ Tomme.

Nr. 233. 16. Juni. Af 5 Pighvarrer fra Dalbybugten havde 3 flydende Rogn. Rødspætte-Yngelen paa Revlerne er nu $1^1/_4$—$1^3/_4$ Tomme, de spise stedse *Copepoder.*

Nr. 234. 11. Juli. I Dammen saas en svømmende Hvarre-Unge (Pighvar). Enkelte lignende iagttoges de følgende Dage, de paavistes ogsaa ved Hjælp af Tobisvaad paa Sandrevlerne i ringere Antal sammen med Skrubbe- og Rødspætte-Unger.

Nr. 235. 24. Juli. Tobisvaad paa Revlerne gav nogle Hundrede Rødspætte- og Skrubbe-Unger fra iaar, desuden 5 Slethvarre-Unger fra iaar c. 2 Tom. lange. En af disse opklippedes, den indeholdt udelukkende *Mysider,* af hvilke der jo vrimler her paa Revlerne.

Pighvarre med moden Rogn leveredes af Fiskehandlerne.

Nr. 236. 14. August. Tobisvaad. Et Træk paa Revlerne. 4 Pighvar 2—2$^{1}/_{4}''$. 1 Slethvar 2$^{3}/_{4}''$. 11 Rødspætter 2—3$^{1}/_{4}''$. 20 Skrubber 1—2$''$. Pelagisk en Pighvarre? $^{3}/_{4}$ Tom. Disse Rødspætter spise nu *Idothea*, *Gammarider*, Muslinge-Yngel og mindre Annelider, de have desuden meget Sand i Maven. Pighvarrerne spise *Mysider* i Masse og havde intet Sand i Maven.

Nr. 237. 31. August. Enkelte Hvarre-Unger samt en lille endnu ubestemt *Pleuronectide*-Larve (*Solea?*) ses i Dammen i disse Dage sammen med Silde- og Brislinge-Unger, *Steenstrupier*, *Thaumantias*, *Oceania*, *Ctenophor*-Unger, *Appendicularier*, *Sagitta*, *Peridinier* etc. Saltholdigheden er særlig stor i disse Dage, og Sildefiskeriet begynder at gaa godt.

Nr. 238. 30. September til 6. Oktober. Smaamasket Snurrevaad ved Havnen paa Revlerne. 3 Træk. 51 Rødspætter fra iaar paa 2$^{1}/_{2}$—5$''$ samt 8 fra ifjor paa 6$^{1}/_{2}$—9$''$. En Del Skrubber af forskjellig Størrelse, de fra iaar ere mindre end Rødspætterne fra iaar. 1 Pighvar paa 4$^{3}/_{4}''$. 3 Slethvar paa 3, 5 og 5$^{1}/_{2}''$, den sidste havde en 2 Tommer lang *Gobius* i Maven. De smaa Rødspætter mellem 3 og 5 Tommer have nu unge *Mactra* og unge *Cardium edule* i Maven, tilhørende Aarets Yngel.

Isingens Yngel fra dette Aar lever ikke paa de Steder, hvor de her omtalte Fladfiskes Yngel findes i disse Farvande, og er overhovedet paa Grund af sin ringe Størrelse vanskelig at paavise i det første halve Aar. (Se dog Undersøgelse Nr. 159).

Appendix II.

On

Some zoological Characters

applicable by the determination

of

Young (post-larval) Flat-fishes.

With two lithographic plates.

For the study of the young fishes of the different species, our seas offer an advantage before many other seas with an abundance of species, viz. that it is easier to find out to which species a little young fish belongs, as we have not so many among which to choose. Nevertheless, the determination is often no easy matter at all; as far as the flat-fishes are concerned, however, I think I have succeeded.

Apart from the Skager Rack and the deepest parts of the northmost Cattegat we can in our little seas expect to find in greater numbers only young *plaice (Pl. platessa), flounders (Pleur. flesus), common dabs (Pleur. limanda), turbots (Rhombus maximus), brills (R. lævis)*, and *the long rough dabs (Hippoglossoides platessoides);* in the Cattegat we may also expect the young *soles (Solea vulgaris & S. lutea), Arnoglossus laterna, Zeugopterus punctatus, Z. norvegicus, Z. megastoma,* perhaps also young *Pleuronectes microcephalus, Pleur. cynoglossus,* and *Hippoglossus maximus.* For the latter three, however, we may also there most likely seek in vain.

In greater numbers I have succeeded in finding only the young of *plaice, flounders, common dabs, turbots, brills,* and *soles.*

When I speak of »young plaice, etc.«, I do not think of the larvæ just developed from the eggs, which so easily may be got by hatching, but of the somewhat larger young fish which generally can be got only by catching them in open nature. Strange to tell, I have in open nature got but very few of the just hatched young fish, partly perhaps, because they are so very delicate that they are washed to pieces in the fishing-gear.

As to the fry of the *sole*, I shall say here only that it is easily distinguished from the fry of other flat-fishes, and simply refer the reader to *Cunningham*'s monograph: *A treatise on the common Sole, 1890.* — There is but one species of the sole, *Solea vulgaris,* which is common in our seas, so as a rule there will be no reason to take into consideration the other species that occurs here. That the latter species, *S. lutea,* even when it is grown-up, is very like the young ones of the common sole, is certain; among other things, however, its large scales are very characteristic.

I shall also refer those readers who might wish to get a closer knowledge of the just hatched young *plaice*, *flounder*, and *common dab* to *Cunningham*'s and *M'Intosh-Prince*'s figures; to judge from my studies of these stages in the development of the fish they are pretty good (particularly the *plaice* and the *flounder*).

One might think, if it is possible to know the young fishes of the various species when they have just come out of the egg, then it must be still easier to know them at the later stages of their lives, and this may be true also; but the fry changes so much *that different features must be used to distinguish one species from the other at the different stages of their lives,* as the earliest features disappear to give room for others. It is just as necessary, therefore, to know these other characteristic features in order to recognize the young ones at their later stages. —

Considerable materials have been collected of young *plaice, flounders,* and *common dabs,* but while the two former species have been gathered in all sizes following immediately *after* the pelagic stage, i. e. plaice which *in our seas* are c. 10^{mm} long, and flounders which are 8^{mm} and upwards, I do not know the young *common dabs* till they are 12—13^{mm} long, caught in November, consequently no short time after the spawning-period.

The materials I have collected contain, on the whole, proportionally little only of *the pelagic stages,* caught in open nature, so that I must put off any closer account of these till more comprehensive materials have been collected. In the mean time I shall say here already, that while the pelagic stage of the *plaice* in our seas is generally ended with a length of c. 10—11^{mm}, that of the *flounder* with c. 8^{mm}, the pelagic stage of the *common dab,* though it belongs to a smaller species, does not seem to be at an end till the fish has reached a length of 12—13^{mm}; at any rate I have found a little pelagic young flat-fish which by the number of its fin-rays, as well as by commencing pigmenting and the form of its mouth, must be determined as a common dab. It was about 13^{mm} long. The specimen was caught at Endelave in July 93. The wandering of the eye was not yet ended, and the specimen no doubt lived **in** the water, not **on** the bottom. The slight pigmenting, decidedly, suggested the same. — The common dab then seems in this respect to form a transition to the *pole dab (Pl. cynoglossus),* where we find a still larger pelagic stage, viz. over 14^{mm} (M'Intosh). The *bottom stages* of both these fishes (the youngest fish), moreover, agree in living only on the deeper water never near the shore as the *young plaice and flounders.*

The expression *bottom stage,* used of the young flat-fishes, means here the stage at which the fry has ceased its pelagic life, and lives on the bottom like the grown-up fish. The whole organisation of the young fish is changed at the same time, and true fin-rays are developed in the pectorals, the last of all the fins which get true fin-rays, at *about* the same time as the life on the bottom is commencing. —

The *flounder* is found on the sands immediately on the shore, represented by specimens as small as 8^{mm} in length (plate II, fig. 12). The smallest are very longish, and may be said almost to be just passing into the pelagic stage. The fins, however, are all present, the median ones evidently with at least nearly their full number of rays. The pectorals, however, are so small that they can be discovered only in particularly good light.

When 12—13^{mm} long (plate II, fig. 11), the form of its body and fins is already very like that of the grown-up flounder. —

The *plaice* also is met with on the sands, 10—11^{mm} of length (the largest specimens at the pelagic stage are at least as long). It is very longish, much more so than flounders of the same length; *by the large number of rays in the median fins it is easily distinguished from the flounder.*

When 12—13^{mm} (plate II, fig. 10), it is still more longish (»sole-shaped») and the form of its body, as well as the number of its rays, makes it very like common dabs of the same length. Yet it is easily distinguished from the latter by its small eyes (the diameter of the apple of the eye is only half the length of that in the average-sized common dab), and by a different pigmenting.

I never met with quite young common dabs on shallow water or together with the fry of plaice and flounder; indeed, I have got them only from one place (at Ærø) on 15 fths. of water (plate II, fig. 9); a single common dab, 1—2 inches of length, I have met with however on shallow water, though very rarely, among thousands of plaice.

When the *flounder* has reached a length of c. 28^{mm}, the spines, which are so characteristic, appear at the base of the dorsal and anal fins. They are best seen when we bend the fins downwards, and look at the spines from the side through a magnifying lens.

At first the spines appear singly, and issue from the hind edge of the scales which are situated, one for each interspinous bone, along the base of the said fins. Before these spines are visible, it will generally be necessary to count the number of fin-rays, in order to distinguish flounders from plaice with certainty. The time when the young fish appear on the shores, and the frequently sinistral specimens among the flounders, moreover, afford holds for the determination. — The young plaice appear on the shore, it seems, a little earlier in the year than the young flounders, and are, particularly at a certain time, as a rule considerably larger. (See the tables.)

When the *common dab* has reached c. 20^{mm} of length (perhaps even before that time), the lateral line becomes distinct, considerably curved over the pectoral, and it is impossible by closer examination to mistake the fish for any other nearly related species.

In order to give some guidance for the determination of the young *plaice*, *flounders*, and *common dabs* at their bottom stage, I shall here state the number of rays counted in the dorsal and anal fins of some of these fishes in the *Danish Seas.*

Of **Plaice** 11—53$^{\mathrm{mm}}$ long	Of **Flounders** 8—33$^{\mathrm{mm}}$ long	Of **Common Dabs** c. 14—46$^{\mathrm{mm}}$ long
1 specimen had 80 rays in the dorsal fin.	1 specimen had 65 rays in the dorsal fin.	1 specimen had 73 rays in the dorsal fin.
1 — — 76 — — — — —	2 — — 62 — — — — —	2 — — 72 — — — — —
2 — — 75 — — — — —	1 — — 61 — — — — —	4 — — 71 — — — — —
3 — — 74 — — — — —	3 — — 60 — — — — —	2 — — 70 — — — — —
5 — — 73 — — — — —	6 — — 59 — — — — —	4 — — 69 — — — — —
4 — — 72 — — — — —	16 — — 58 — — — — —	1 — — 68 — — — — —
6 — — 71 — — — — —	10 — — 57 — — — — —	1 — — 67 — — — — —
12 — — 70 — — — — —	18 — — 56 — — — — —	2 — — 66 — — — — —
6 — — 69 — — — — —	22 — — 55 — — — — —	2 — — 65 — — — — —
8 — — 68 — — — — —	16 — — 54 — — — — —	
9 — — 67 — — — — —	17 — — 53 — — — — —	
5 — — 66 — — — — —	7 — — 52 — — — — —	
7 — — 65 — — — — —	5 — — 51 — — — — —	
1 — — 64 — — — — —	1 — — 49 — — — — —	
3 — — 63 — — — — —		
2 — — 61 — — — — —		
1 specimen had 57 rays in the anal fin.	1 specimen had 43 rays in the anal fin.	5 specimen had 55 rays in the anal fin.
2 — — 56 — — — — —	9 — — 42 — — — — —	6 — — 54 — — — — —
5 — — 55 — — — — —	3 — — 41 — — — — —	3 — — 53 — — — — —
6 — — 54 — — — — —	18 — — 40 — — — — —	4 — — 52 — — — — —
13 — — 53 — — — — —	21 — — 39 — — — — —	1 — — 51 — — — — —
9 — — 52 — — — — —	32 — — 38 — — — — —	
10 — — 51 — — — — —	13 — — 37 — — — — —	
9 — — 50 — — — — —	16 — — 36 — — — — —	
9 — — 49 — — — — —	10 — — 35 — — — — —	
5 — — 48 — — — — —	1 — — 34 — — — — —	
5 — — 47 — — — — —	1 — — 33 — — — — —	
1 — — 46 — — — — —		

These numbers of rays are, as it will be seen, pretty well distinguished in plaice and flounders (particularly in the anal fin); on the other hand they are nearly always identical in common dabs and plaice. — The number of rays in the caudal fin will only now and then help us out of that difficulty, as the plaice has here 18, 19, 20, 21, the flounder 16, 17, 18, and the common dab generally 18. There are, however, exceptions from this rule.

It seems as if the full number of rays is formed immediately in the beginning of the bottom stage; I have made no countings, however, to see if not a few rays are added afterwards. But it cannot be denied that there is some *difference in the number of rays in the dorsal as well as in the anal fin of the plaice in the northern Cattegat, compared to those in the southern at Grenaa and at the northern parts of the Great Belt.*

In 39 *plaice,* not over 19^{mm} in length, from *Frederikshavn,* the average number in the dorsal fin was 68, in the anal fin 53. Only one had 49 in the anal fin, all others higher numbers. Only one had 65 in the dorsal fin, all others higher numbers.

In 15 *plaice from Samsø,* 3 under 20^{mm}, 12 over 20^{mm} in length, the average number in the dorsal fin was only 67, in the anal fin 49. 9 had 47 and 48 in the anal fin, 1 had 49, the remainder more than 50. 4 had under 65 in the dorsal fin, 10 more than that.

I shall not go further into these enumerations, which must be carried out on a greater scale at some future period in order to further elucidate this matter, which is, I suppose, connected with the occurrence of the various races of plaice, whose sizes I have mentioned in an earlier part of this report. — I should scarcely have seen, on this occasion, that my countings suggested the above stated facts, had not *Georg Duncker* in Kiel, written to me about his researches of the plaice in the Baltic Sea — for which I thank him, hoping soon to see some further information on the matter.

The number of rays in the *flounder* does not show any difference in the various seas — though a great many have been counted — nor might this reasonably be expected, as this fish does not, like the plaice, show any distinguishable decrease in its length in the more inshore waters.

The fry of the two species of *Pleuronectes* here mentioned can never, after the pelagic stage, be mistaken for that of our other species of *Pleuronectes: Pl. microcephalus* and *Pl. cynoglossus,* the number of rays in the dorsal and anal fins of these being exceedingly great. In the former the dorsal fin has c. 92, in the latter as many as 111—117 rays. (See the figures, plate II, fig. 13, 14, as also the pictures of *Pl. cynoglossus* in *M'Intosh* and *Prince's* great work, plate XVIII, fig. 7—9). It might be thought, perhaps, that another of our flat-fishes, the long rough dab *(Hippoglossoides platessoides),* might rather be mistaken for a species of *Pleuronectes,* but it is most nearly related to the *large-mouthed flat-fishes.* (See however *Malm's* mistake in his »*Fauna*« p. 510, and his earlier paper on this subject).

It seems as if the plaice is not the only flat-fish which occurs in local or geographical races (varieties), nor does the number of rays appear to be the only varying race-character; for also the long rough dab *(Hippoglossoides platessoides)* seems to grow larger on the shores of Iceland and Greenland, and has there a greater number of rays in the median fins, than it has on our shores; it seems also as if the transition from the pelagic stage to the bottom stage occurs at a considerably greater length among the large races than among the small ones, to judge from the specimens lying before me from Norway and Greenland. One specimen from Greenland, 35^{mm} long, has thus, as yet, no real rays in the pectorals, while specimens from Norway, as long as $27,_5{}^{mm}$ (see fig. 19, plate II), have got such; moreover they have adopted the more longish form which makes them more like the adult fish and more different from the peculiarly broad (rather tall) pelagic young ones with their particularly projecting stomach-region and the concave profile of their heads. (See plate II, fig. 18.) By the two last-mentioned characters, as also by the peculiar form of its mouth, the long rough dab distinguishes itself from the genus *Pleuronectes* and approaches the large-mouthed flat-fishes, especially the species of *Hippoglossus,* to which this fish, evidently, is nearly related. The species of *Hippoglossus* and the *long rough dab* have also that peculiarity in common that the pelagic young ones become large before they take the form of the grown-up fish and the bottom stage commences. Plate II, fig. 20, represents the outlines of a *Hippoglossus vulgaris,* 32^{mm} long, from Christianssand (the specimen mentioned by *Collet* in »Norges Fiske« and by *Lilljeborg* in »Sveriges och Norges Fiskar«), and plate II, fig 21, a 51^{mm} long *Hippoglossus hippoglossoides* from Greenland. Both are furnished with true rays in the median fins, but the specimen fig. 21 has scarcely as yet got the whole number, and it was rather badly preserved, so that the rays could not be counted. — The pectorals are quite larval in both, and both fish must be supposed to have a long time to wait before the pelagic stage is over, particularly the Norwegian specimen, whose left eye has just *commenced* its wandering; for the rest the fish is symetrical. The number of rays is, in its dorsal fin c. 104, in its anal fin 88, in its caudal fin 22, which agrees very well with the European halibut; the number of rays in the anal fin, however, seems to be somewhat greater than that stated by *Lilljeborg* with respect to this fish, and approaches very much the number in *Pleuronectes cynoglossus,* with whose number of rays in the median fins the number of rays in this young fish also agrees very nearly. Yet there is no doubt that it must be classed among the large-mouthed flat-fishes: moreover it has a row of spines or spikes down the operculum, and a few scattered spines behind this row (suggested in plate II, fig. 20), a character which makes it more different from the *Pleuronectes*-group and approaches it to the genus *Rhombus,* to which, we know, the *Hippoglossus* is not so very distantly related. Slight pigment-spots may be traced in the figure at the places indicated.

In the *Greenland* form (plate II, fig. 21) no spines could be discovered. On account of the smaller number of rays in its fins, c. 70 in the anal fin and c. 19 in the caudal fin (the rays in the dorsal fins could not be counted with certainty owing to its being so badly preserved), I have considered it a specimen of a species of halibut living in Greenland, viz. *Hippoglossus hippoglossoides.* It was slightly pigmented and had, particularly, large spots along the interspinous bones. — But our common halibut grows as large as this before it passes into the bottom stage; nay, we might expect that it grew still larger, as the adult fish is so much larger than the Greenland species. — About this however, as far as I know, we have no information.

The fry of *turbot* and *brill* has been gathered in considerable numbers, at their *pelagic stage* as well as at the following stage of their lives, when they live on the bottom near the shores among the fry of plaice and flounder.

It has always surprised me that I could so easily collect considerable materials of the pelagic fry of turbot and brill, while the pelagic stages of the other species of flat-fishes are, proportionally, so difficult to catch.

In the Scandinavian and Danish literature the fry of the genus *Rhombus* has long been known and partly described (that of the *brill* by *Malm* and *Schiødte*); therefore it cannot be accidental that it has also so frequently been gathered by me.

This is either solely owing to its inclination to drift along with the current in the *surface* of the water on warm, calm days, or perhaps the reason may be also to some extent that these fish are larger and less delicate at their pelagic stage than the other flat-fishes, and therefore not so easily overlooked in the fishing-gear.

In this connection I shall again mention that the fry of turbot and brill goes much farther into our sounds and the Belts than the young plaice which must be said to be missing on our Baltic shores and in the southern parts of the Belts. May not this be connected with a different way of living at their pelagic stage?

However now this may be, I have gathered the fry of *Rhombus* in considerable numbers at their *pelagic stage* as well as at their later *bottom stage*. It is, as far as I know the literature, the first time that more considerable materials of *both species* have been gathered together, and as there has been and still is great uncertainty in the determination of these, as well as of the other young fishes of the *Rhombus*-group, I shall here describe their outer appearance at their various stages a little more closely.

When the young turbot and brill at their pelagic stage are c. 15$^{\mathrm{mm}}$ long (somewhat smaller young ones, see plate I, fig. 3 & 7), all the fins are visible, but the pectorals have still embryonic fin rays. The wandering of the eye has commenced, but the right eye is not yet on the frontal edge. — Both sides are highly pigmented (black), and on the dorsal fin are seen several (often 6) dark spots (or streaks) which spread over the body across the interspinous bones. On the anal fin are seen 4 spots like these. — The brill has a more longish body than the turbot, and the profile of the forehead is of a somewhat different form; in the brill the length of the snout is considerably larger than the diameter of the eye, but in the turbot it is nearly equal to it; both these characters are found also in the grown-up fish.

The character which, without leaving any doubt, settles the question of turbot or brill, is, besides perhaps the number of rays in the median fins which already now is greater in the brill, *the head of the turbot which is heavily armed with spines* and, particularly over the left eye, has a *sharp, projecting, angular spiny crest of bone* besides *rows of spines down the operculum,* and several scattered *spines on the* *hindmost part of the operculum, 3—6 spines on the under side of the lower jaw, and two large groups of spines at the upper end of the claviculæ. (M'Intosh's »otocytic spines«).*

Of all these spines with which the turbot is thus accoutred, particularly on the left side of its head, there are but slight suggestions in the brill*); certainly, there are little spines at several of the same places where we find them in the turbot, but, partly, they are so smal that they scarcely protrude from the skin, partly *the angular crest over the eye is quite missing as such,* though a very inconsiderable row of spines may replace it.

The whole spiny equipment is subject to some variation in both species; but the projecting crest over the left eye is so distinct that it may easily be seen with a weak magnifying lens, and it is always characteristic of the turbot; — it is to be found also over the right eye.

In a turbot of 21 mm (plate I, fig. 2), which had true rays in *all* its fins, and evidently also the full or nearly the full number of rays, 62 in the dorsal fin and c. 47 in the anal fin, and which by its round form and short snout**) clearly proved to be a turbot in transition between the pelagic stage and the bottom stage, there were still traces left of the strong crest over the left eye, spines on the shoulder and a few scattered ones on the operculum, but the whole spiny equipment as well as the crest was now fast disappearing. — The right eye was just situated on the frontal edge. — The right side of the fish had still traces left of the spines, but the pigmenting was very slight. —

I have not got any brill at a stage exactly corresponding to this in size, but in a young one, c. 20 mm long (plate I, fig. 6) whose right side was only slightly pigmented, and whose right eye is situated on the frontal edge, the spiny equipment is quite disappeared with the exception of a few spines at the hind-edge of the operculum. This young brill had still embryonic fin rays in the pectorals.

The pectoral gets its true rays last of all the fins; when they have appeared the pelagic stage is at an end, and the fish goes to live on the bottom. Before I mention the bottom stage, however, I must make some observations on the pelagic young ones, which are *smaller* than the above-mentioned c. 15 mm long young turbots and brills.

Already with a length of 7—8 mm, the smallest young ones I have collected (plate I, fig, 4 & 8), the turbot has got the peculiar spiny equipment of its head, while I have seen no such thing in brills of the same length. On the frontal-edge of the brill, on the other hand, a peculiar soft hump appears, just before the foremost rays of the dorsal fin; it disappears later on during the wandering of the eye, and it seems as if the turbots never get anything quite corresponding to this.

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*) See also *Schiødte's* picture of it.

**) This is on the whole, an excellent mark to distinguish also between larger turbots and brills. — In young ones under 8 mm, this difference is not so conspicuous.

It seems as if turbots, compared to brills of the same length, are somewhat in advance in their development. When 7—8mm, for instance, the turbot has traces of true rays in all the median fins, and chorda is curved considerably upward in the tail; brills of this length have scarcely any but embryonic rays in all the fins (though the fins are all formed) and chorda is curved only a little upward. — The turbot is often more pigmented on the body than the brill.

In young turbots of 10—11mm (plate I, fig. 3 & 7), the spiny equipment of the head is fast developing while in brills of the same size we can discover only slight traces of it by means of the microscope. The turbots are always in advance of the brills in development, and more pigmented on the body. In all median fins true fin-rays are formed, though not in the full number; we may see however, whether we have before us a form with many rays (brill) or with but a few ones (turbot), as there are only wanting a smaller number at the ends of the median fins. Both species are at this stage very longish.

This stage forms the transition to the above-mentioned (not represented) young ones of c. 15mm, which again by little and little enter into the following stage, the young fish of c. 20—22mm (plate I, fig. 2 & 6); nay, the transition is so even that we can scarcely speak of different stages. It is not till the fish from their pelagic life enter into the life on the bottom that we can indeed speak of *a new stage: the bottom stage.*

At the bottom stage (plate I, fig. 1 & 5) all the spiny adornments of the head have disappeared, with the exception, perhaps, of a slight trace of the crest on the left side of the turbot, now situated between the eyes. Both eyes are situated on the left side, which is highly pigmented, while the right side is without any pigment. All fins appear to have their full number of rays, and the form of the fish is in the main like that of the grown-up one. — The pigmenting is to a certain degree characteristic of either species, but it is a difficult thing to express the difference in words. When I say that the body of the turbot has often large pale spots, while other parts of the body and the fins are dark, and that it has often light spots on dark ground, while the colours of the brill are more dotted about, this is but in part an appropriate description.

I have turbots, only 18mm long, which are fully metamorphosed, while the above-mentioned turbot, which was not yet quite metamorphosed, was 22mm. Can this be owing to an individual variation, or do the animals become shorter by the metamorphose? Something like this seems to take place also in the brill and the plaice*).

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*) Also the transition of the plaice from the pelagic stage to the bottom stage is accompanied by a thorough change in many of the organs of the flat-fishes. The skin of these fishes seems to change, also the muscles, I dare say. The whole bulk of the fish is smaller, and after the metamorphose it is thinner than it was before, particularly in the fins. The specific gravity of the fish is evidently much higher. This will apply to the young ones of all the flat-fishes I have studied.

When the turbots and brills are c. 33^{mm} long, the scales and permanent spines appear. The spines of the turbot are transformed scales, and it is easy to follow their development; first large, oblong, true scales appear in the skin, later on these are transformed into spines. This transformation does not begin at the same size in all specimens; in turbots of a length of several inches we may sometimes in the skin see many scales without any spine-formation, so that we would scarcely, without any further investigation, really believe that it is a turbot we have before us. The scales, however, are situated far from one another, as the spines afterwards, and do not form a real coat of scales as the case always is in the brill. — May not Malm's *Rhombus hybridus* be a turbot whose spine-formation somehow or other has been checked? — Cmp. also the other individuals mentioned in literature as supposed hybrids between turbots and brills.

At the bottom stage of turbot and brill the number of rays in the dorsal and anal fins affords good characters in our seas; it seems however that the number of rays may be somewhat different in other seas. (Cmp. for instance: *M'Intosh, 10. Annual Report. Fishery Board for Scotland.*)

Of **Turbots***) from 8—240^{mm}	Of **Brills** from 11—182^{mm}
1 specimen had 70 rays in the dorsal fin.	3 specimens had 80 rays in the dorsal fin.
1 — — 68 — - - — -	6 — — 79 — - - — -
4 — — 67 — - - — -	7 — — 78 — - - — -
17 — — 66 — - - — -	7 — — 77 — - - — -
19 — — 65 — - - — -	9 — — 76 — - - — -
29 — — 64 — - - — -	24 — — 75 — - - — -
32 — — 63 — - - — -	13 — — 74 — - - — -
25 — — 62 — - - — -	18 — — 73 — - - —
29 — — 61 — - - — -	1 — — 72 — - - — -
18 — — 60 — - - — -	1 — — 71 — - - — -
4 — — 59 — - - — -	2 — — 70 — - - — -
4 — — 58 — - - — -	
1 — — 57 — - - — -	
1 — — 56 — - - — -	
1 specimen had 51 rays in the anal fin.	4 specimens had 60 rays in the anal fin.
3 — — 50 — - - — -	3 — — 59 — - - — -
6 — — 49 — - - — -	4 — — 58 — - - — -
18 — — 48 — - - — -	9 — — 57 — - - — -
39 — — 47 — - - — -	13 — — 56 — - - — -
39 — — 46 — - - — -	21 — — 55 — - - — -
39 — — 45 — - - — -	22 — — 54 — - - — -
28 — — 44 — - - — -	12 — — 53 — - - — -
8 — — 43 — - - — -	1 — — 52 — - - — -
4 — — 42 — - - — -	2 — — 51 — - - — -

While counting the rays in the above specimens, only one specimen (a brill of c. 22^{mm}) was found, which could not be determined by the number of rays only; it had 70 in the dorsal fin and 51 in the anal fin; otherwise a great (or small) number of rays in one fin is usually not followed by a great (or small) number in the other.

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*) Counted by Mr. *Th. Mortensen* as also those p. 128.

Both *Raffaele* and *M'Intosh* have given pictures of various specimens of *Rhombus.* I can only say with certainty that the one represented in »11. Annual Report. Fishery Board for Scotland«, table XII, fig. 7, is a turbot; for the characteristic spines of the head are here suggested, however slightly.

Fig. 14, plate XIV, in »10. Report« is, I dare say, also a turbot.

According to the number of rays (80 in the dorsal, 60 in the anal fin), one might decidedly think that *Rafaele's* fig. 8, plate 4, was a *brill,* what he himself also supposes it to be; but the figure certainly is more like a turbot, both with regard to the form of body and fins, and with regard to the pigmenting. Of his two other figures I cannot say anything for certain neither, as they show nothing of the spiny equipment of the head; to judge from the length of the snout in all the figures, the fish represented, however, must be supposed to be brills. — *Holt* has in J. M. Biol. Assoc. (N. S.) vol. II, pp. 401—404 given a closer description of a number of little young *Rhombus,* which in many ways, for instance in the spiny equipment of the head, agree with my young specimens of *R. maximus,* only his young ones want every trace of spines on the shoulder. He supposes, however, that they belong to *R. maximus.* Till the publishing of his further accounts I shall not enter into this question. —

Of *Arnoglossus laterna* I know no specimens in the true larval state, i. e. before the pectorals have got true rays; the youngest specimen before me, from *Hvaløerne,* caught by *G. O. Sars,* is 23 mm long and furnished with scales; the outlines of it are given plate II, fig. 17, particularly in order to compare it to the young ones of the other species of flat-fishes. The specimen agrees in all principal relations with the grown-up animals. — Of the genus *Zeugopterus* I have before me a young specimen of *Z. norvegicus,* 13 mm long, caught by *G. O. Sars* at *Flekkerø* in Norway; as yet it has no rays in the pectorals, nor has it any scales. In spite of its small size it resembles the adult fish (cmp. plate II, fig. 16), in its whole form as well as in the peculiar position of the eyes, and in the character that the two median fins are turned round on the right side of the tail; by this means if by nothing else, it is easy to determine both its genus and its species.

Of *Zeugopterus punctatus* I have also before me a pretty little specimen, 13 mm long, taken in August at *Bodø* by *G. O. Sars* (plate II, fig. 15). The form of the fish agrees in all principal relations with that of the grown-up animal, but the pectorals have yet only traces of true rays. The distribution of the colours is peculiar however, the left side of the animal being dotted with roundish, dark spots of about the same size, evenly distributed over the whole fish, both on head, body, and fins; among these dark spots there are pointed, soft warts like those which are found on the somewhat older animals.

The fins being turned rund on the right side of the tail, the position of the ventral fin, the far projecting dorsal fin, etc. do not leave the slightest doubt that this fish is a young *Zeugopterus punctatus;* it cannot be *Z. norvegicus,* nor *Z. megastoma* whose young ones are quite unknown to me; its fin-equipment at the tail must make its young ones easily distinguishable from the two other species of *Zeugopterus,* and no more species, we know, are living on the shores of Norway.

I have thought that these *outlines of our rarer young flat-fishes* as also of *the Greenland halibut* will not be without some interest to those naturalists who at some later period might try to look for the still missing stages, as they will facilitate the determination of the species that might be found; and I seize the opportunity to thank Professor *Chr. Lütken* in Copenhagen and Professor *R. Collett* in Christiania for having so readily placed the collections of their museums at my disposal on this occasion.

I have in the *shallow*, sandy, Danish seas been able only to find young ones of *plaice, flounder, common dab, sole, turbot, and brill,* and must suppose therefore that the fry of the other species *which are common in our seas as grown-up fish,* must live on more or less deep water; these missing species have also, although in but small numbers, been taken in the *deep* Norwegian and Greenland fjords; viz.:

Hippoglossus vulgaris at Norway.
Hippoglossus hippoglossoides at Greenland.
Hippoglossoides platessoides at Norway and Greenland.
Pleuronectes cynoglossus & Pl. microcephalus at Norway.

That the little rare species of *Zeugopterus,* as also *Arnoglossus,* have been taken only in small specimens on the shores of Norway, is perhaps rather owing to the indefatigable activity of Prof. *G. O. Sars* with the dredge there, than to their absence from the Cattegat properly so called.

Note: The numbers I & II of the plates have by a mistake sometimes been interchanged.

Explanation of the Plates I & II.

Table I, fig.	1.	*Rhombus maximus.*	Bottom stage. No spines on the head.
— - —	2.	—	Transition from the pelagic stage to the bottom stage; distinct traces of spines on the operculum, a crest between the eyes, and spines on the shoulders.
— - —	3.	—	Pelagic stage with a heavy spiny equipment. Embryonic fin-rays in the pectorals.
— - —	4.	—	Pelagic stage. Smaller than the preceding one. Heavy spiny equipment.
— - —	5.	*Rhombus lævis.*	Bottom stage. No spines at all.
— - —	6.	—	Pelagic stage. Spines on the operculum. Embryonic fin-rays in the pectorals.
— - —	7.	—	Pelagic stage. Smaller than the preceding one. Spines on the operculum.
— - —	8.	—	Pelagic stage. No spines at all.
Table II, fig.	9.	*Pleuronectes limanda.*	Bottom stage. Pectorals exceedingly small.
— - —	10.	*Plenronectes platessa.*	Bottom stage. Pectorals exceedingly small.
— . —	11.	*Pleuronectes flesus.*	Bottom stage*).
— - —	12.	—	Younger bottom stage.
— - —	13.	*Pleuronectes microcephalus.*	Bottom stage. (Norway.)
— - —	14.	*Pleuronectes cynoglossus.*	Bottom stage. (Norway.)
— - —	15.	*Zeugopterus punctatus.*	Bottom stage. (Norway.)
— - —	16.	*Zeugopterus norvegicus.*	Bottom stage. (Norway.)
— - —	17.	*Arnoglossus laterna.*	Bottom stage. (Norway.)
— - —	18.	*Hippoglossoides platessoides.*	Pelagic stage. (Norway.)
— - —	19.	—	Bottom stage. (Norway.)
— - —	20.	*Hippoglossus vulgaris.*	Pelagic stage. (Norway.)
— - —	21.	*Hippoglossus hippoglossoides.*	Pelagic stage. (Greenland.)

(The pictures are all drawn by means of *camera lucida*).

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*) *Note:* Has true fin-rays in the pectorals, but these are not indicated in the figure.

Appendix III.

The yearly Value of our Flat-fish fisheries.

With a Chart.

»The Value of the Flat-fish fisheries in the Danish Seas, 1891, graphically represented«, which is attached to this report, is based on the official statistics, and is intended to give a passably correct idea of the places in the seas where the fish are caught, by means of red dots on the chart, a dot for each 1000 Kroners. The statistics does not give such special information of the exact spots where the fish are caught, as the chart, but the dots are distributed to the best of my knowledge *within the limits indicated by the statistics;* moreover, I have tried to supplement my own knowledge, acquired through several years of intimate acquaintance with the fishery, with the experience of well-informed men, among whom particularly Lieutenant *Hansen* has been of great help to me.

When I have chosen the year 1891, the reason is that we have statistics for this year of the Danish fishery in the German Sea and the Skager Rack as well as within the Skaw; moreover the said year, for aught I know, may very well be looked upon as an average year, so that the general impression it gives will apply also to other years. We see immediately how much more important the fishery is in the *Cattegat* and the *Skager Rack* (as far as *Hanstholmen*) than in the other seas the *German Sea* and the *smaller waters*, the latter, evidently, because there are not very many flat-fishes, the German Sea because the Danes only fish very little there. The Limfjord is the richest of our inshore waters, giving 200,000 Kroners a year. While the German Sea, from Esbjerg as far as Hanstholm, yields an income of a little more than 100,000 Kroners*), and the smaller seas at Funen and Sealand nearly 150,000 Kroners, the Cattegat has over 700,000 Kroners, and the Skager Rack more than 300,000 Kroners (The Skaw being included in the Cattegat). All this counted together gives consequently an income of nearly $1^1/_2$ million

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*) The statistics of this sea does not include the months of January & February 1891; but the profit on flat-fishes in that time is so small that it can scarcely have any greater influence on the matters here represented.

Kroners from the flat-fish fisheries, and it is the *plaice* which here gives by far the greater part of this sum. In the Cattegat *soles, turbots,* and *brills* are of some (not very considerable) importance, and in the little fjords of Sealand and Funen the *flounder* gives a slight profit. —

Though the Cattegat, properly so called, and the Skager Rack are thus the principal fishing-grounds where our sea-going cutters fish with their plaice-seines, it must astonish to see the comparatively great value of the Limfjord fishery. It has been necessary here to make the dots small to get room for them. On the other hand it is remarkable to see how little the Issefjord gives, particularly when we learn that the small quantity caught there chiefly consists in *flounders* and *soles*, not in plaice as in the Limfjord. Before the breaking through of the Limfjord towards the west (in 1825) there was, on the other hand, to judge from old accounts, only a very insignificant plaice fishery here; all the young plaice in this fjord seem to immigrate yearly from the German Sea. (Cmp. *ante.*)

The Baltic Sea from Copenhagen to Gjedser and the southern shores of the isle of Lolland are very deficient in marketable plaice, which agrees very well with the fact that the plaice is here very small and, as a rule, scarcely able to propagate.

When the seas around Samsø are apparently even mor deficient in plaice than the Great Belt, the reason evidently is that so few fishermen fish here, owing to the isolated situation of this island and the unsatisfactory means of communication.

The fishery south of a line *Grenaa—Kullen* is carried on principally as shore fishery with *gill-nets,* north of this line particularly with *plaice-seines* as deep-sea fishery with large boats.

In the Limfjord the fishery is a shore fishery, consequently with small boats but chiefly with *plaice-seine.*

Appendix IV.

On the labelling of living Plaice.

Through not a few years I have tried to label living plaice, in order to place them in our seas again, and thus, with the assistance of the fishermen who afterwards catch them, to obtain information of the places where they are fished, and of the size which the labelled fish have reached in the mean time.

The first experiments showed, in spite of the deficient labelling, that a considerable number of fish placed in the sea are caught again, often nearly $^1/_3$ in the course of a fishing-season, and that we, therefore, by improving the labelling, might hope in this way to obtain reliable information of the migrations and growth of the plaice; nor have I been disappointed in this hope. —

Without here entering into the details of the labelling, I shall mention that the main points in these experiments are to label the fish 1) in such a way that it does not hurt them, 2) so well that the labels do not drop off, 3) in such a conspicuous way that the fishermen see the labels, and 4) we must make the fishermen interested in the matter so that they send in the fish they have caught.

The first labels I used would not last very long (2—3 months); afterwards I have used some (two buttons of bone with a No. burnt into them, kept firmly in their position by a silver thread right through the fish between the interspinous bones of the dorsal fin) which last longer — about a year or more. While the former labels, as a rule, only gave information as to 1) how many of the labelled fish there were caught again, and 2) where these had gone in the mean time, the latter also give information as to the growth of the fish. These latter labels have since almost exclusively been used in the Limfjord. — In the following list I have given the results of such a labelling of c. 1000 plaice in the months of March & April 1893. It will be seen that in all 51 were caught and *sent in* to the fishery officers and to Mr. *Tachou*. By far the greater number of these fish were delivered up at Thisted Bredning, where Mr. *Tachou* has understood how to make the fishermen interested in this matter; the latter fact is evidently the main reason why so many labels have come in from Thisted. — It will be seen also that the fish grow very fast in the Limfjord (cmp. *ante*), so that for instance a plaice

(No 83), which was labelled and placed in the sea on the 30th of March when it had a length of $8^1/_2$ inches, in October the same year measured $13^1/_2$ inches. All the fish that have been caught again have grown somewhat larger, as far as we know.

That only the above-mentioned 51 labels have been sent in, is owing to two reasons: 1) that the fishermen do not take any interest in the matter, so that they will not send in the labelled fish; 2) that the labels, most likely in the winter 1894, have dropped off, i. e. they have positively grown out of the plaice, the silver thread making its way along the interspinous bones and afterwards along the fin-rays. I have seen several fish with a distinct scar after a labelling.

I have not fully succeeded, therefore, in finding a sufficiently durable label, but the results, nevertheless, seem to me to be of considerable interest. I shall give them therefore in the following list. In the last column it is generally stated by whom the fish have been measured; personally I have had the oportunity of seeing them in a dried state only.

Labelled Plaice in the Limfjord. 1893.

No.	Where placed in the sea.	1893. Date.	Length.	Where caught.	1893. Date.	Length.	Measured by.
336.	North of Fuur.	9. April.	$9^1/_2$ inch.	Sallingsund?	19. May.	$9^3/_4$ inch.	Tranum.
623.	Aggerø Dyb as far as Vilsund.	17. April.	$7^1/_2$ —	South of Mors.	May.		
681.	—	—	$9^1/_2$ —	—	—		
696.	Aggerø Dyb as far as Vilsund.	17. April.	9 —	Tæbring and Dragstrup Cove.	May and June.	?	Sent in 14. Jan. 1894.
673.			9 —				
612.			$7^3/_4$ —				
132.	Thisted Bredning.	30. March.	$9^1/_2$ —	Thisted Bredning.	10. June.	$11^1/_2$ —	Tachou.
152.	—	—	9 —	—	18. June.	$11^1/_2$ —	—
74.	—	—	9 —	—	—		—
690.	Aggerø Dyb as far as Vilsund.	17. April.	8 —	Vilsund.	—	$10^3/_4$ —	Unknown.
184.	Thisted Bredning.	30. March.	9 —	Thisted Bredning.	24. June.	$11^3/_4$ —	Tachou.
369.	North of Fuur.	9. April.	$8^3/_4$ —	Boeløre in Kaas Bredning.	—	$11^1/_4$ —	Tranum.
594.	Louns Bredning.	10. April.	9 —	Louns Bredning.	26. June.	$11^3/_4$ —	—
274.	Risgaard Bredning.	9. April.	$8^1/_2$ —	Risgaard Bredning.	3. July.	$11^3/_4$ —	—

No	Where placed in the sea.	1893. Date.	Length.		Where caught.	1893. Date.	Length.		Measured by.
780.	Visby Bredning as far as Vilsund.	17. April.	$9^{1}/_{4}$	inch.	Vilsund.	3. July.	$12^{1}/_{2}$	inhc.	Tachou.
349.	North of Fuur.	9. April.	$9^{3}/_{4}$	—	Livø Bredning.	4. July.			
105.	Thisted Bredning.	30. March.	$8^{3}/_{4}$	—	Thisted Bredning.	6. July.	$11^{1}/_{2}$	—	Tachou.
95.	—	—	$10^{1}/_{4}$	—	?	—			
99.	—	—	$6^{3}/_{4}$	—	Thisted Bredning.	—			
796	Visby Bredning as far as Vilsund.	17. April.	9		— ?	— ?			
890.	Sallingsund.	25. April.	$8^{1}/_{2}$	—	—				
642.	From Aggero Dyb as far as Vilsund.	17. April.	$9^{1}/_{2}$	—	Vilsund.	6. July.	12	—	Tachou.
754.	From Visby as far as Vilsund.	—	9	—	—	—	11	—	—
886.	Sallingsund.	25. April.	$8^{1}/_{2}$	—	Sillerslev in Kaas Bredning.				
91.	Thisted Bredning.	30. March.	$9^{1}/_{2}$	—	Thisted Bredning.	9. July.	$12^{1}/_{2}$	—	Tachou.
354.	North of Fuur.	9. April.	9	—	Sallingsund.	12. July.			
484.	—	—	9	—	Caught?				
208.	Risgaard Bredning.	—	$8^{1}/_{2}$	—	Kaas Bredning.				
902.	Thisted Bredning.	25. April.	$9^{1}/_{4}$	—	Thisted Bredning.	12. July.	12	—	Tachou.
102.	—	30. March.	$8^{1}/_{2}$	—	—	13. July.	$10^{1}/_{4}$	—	—
172.	—	—	$8^{1}/_{2}$	—	Visby Bredning.	14. July.			
8.	—	—	$9^{1}/_{2}$	—	Thisted Bredning.	15. July.	$12^{1}/_{4}$	—	Tranum.
5.	—	—	8	—	—	—	$11^{1}/_{2}$	—	—
10.	—	—	$9^{3}/_{4}$	—	—	—	$12^{1}/_{4}$	—	—
378.	North of Fuur.	9. April.	$9^{1}/_{2}$	—	Jørsby Livø Bredning.	16. July.	12	—	—
865.	Sallingsund.	25. April.	$7^{3}/_{4}$	—	Venø Bay.	28. July.			
339.	North of Fuur.	9. April.	9	—	Kaas Bredning.	July.			
181.	Thisted Bredning.	30. March.	$8^{3}/_{4}$	—	Vilsund.	8. Aug.	12	—	Tranum.
175		—	$8^{3}/_{4}$	—	—	—	$11^{1}/_{4}$	—	—
903.	—	25. April.	8	—	—	—	11	—	—
533.	Louns Bredning.	10. April.	8	—	Louns Bredning.	10. Aug.	13	—	Spillerberg.

No.	Where placed in the sea.	1893. Date.	Length.	Where caught.	1893. Date.	Length.	Measured by.
164.	Thisted Bredning.	30. March.	$9^3/_4$ inch.	Thisted Bredning.	14. Aug.	14 inch.	Tranum.
463.	North of Fuur.	9. April.	8 —	Venø Bay.	17. Aug.	$8^1/_2$ —	—
730.	Visby Bredning as far as Vilsund.	17. April	9 —	Thisted Bredning.	19. Aug.	12 —	—
701	Aggerø Dyb as far as Vilsund.	—	$9^3/_4$ —	—	15. Sptbr.	$12^1/_2$ —	Tachou.
147.	Thisted Bredning.	30. March.	$9^1/_4$ —	North of Thisted Harbour.	2. Octbr.	13 —	—
98.	—	—	10 —	—	4. Octbr.	12 —	—
83.	—	—	$8^1/_2$ —	Thisted Bredning.	October.	$13^1/_2$ —	
45.	—	—	$9^1/_4$ —	East of Vilsund.	1. Novbr.	$14^3/_4$ —?	Tachou.
435.	Livø Bredning Ravnedyb.	9. April.	$9^1/_2$ —	Between Fuur and Livø.	Novbr.		The fishermen state $14^1/_2$ inch.
747.	Vilsund.	17. April.	9 —	Thisted Bredning.	1. Decbr.	$13^1/_2$ —	C. G. Joh. Petersen.

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Indeholder i Part III. **Scientific Investigations** en Mængde Afhandlinger om beslægtede Emner af:

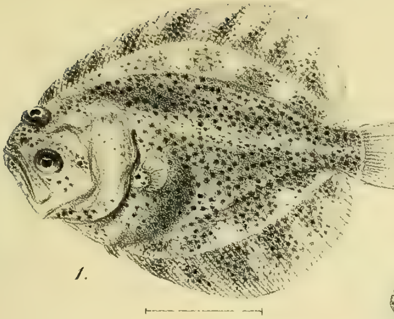
Dr. T. **Wemyss Fulton.** (Superintendent of Scientif. Investigations.)
Prof. **M'Intosh.** (St. Andrews Marine Laboratory.)
J. **Fullarton.**
H. C. **Williamson.**

I hver Aargang (Part III) gives en Oversigt over praktisk-videnskabelige Arbejder i Europa paa Fiskeriomraadet: »Contemporary Work«, til hvilken henvises. —

Marts 1894.

Forfatteren.

Tavle II (Den danske biol. Station IV) (Fiskeri Beretning 1893-94.)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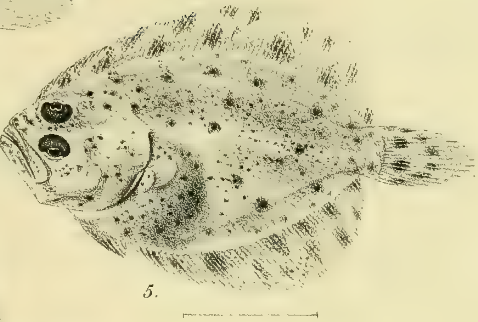
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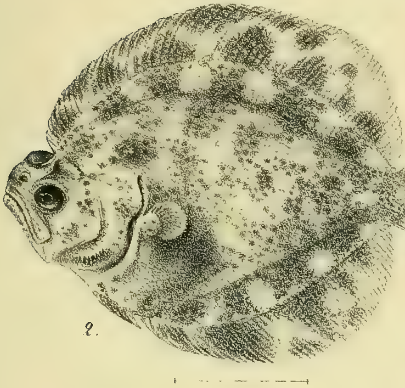
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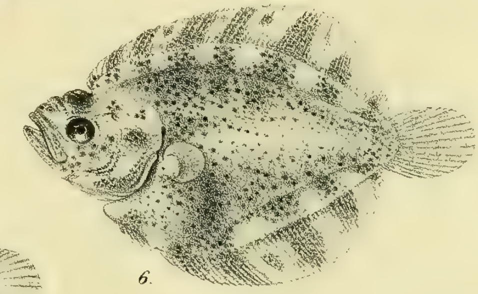
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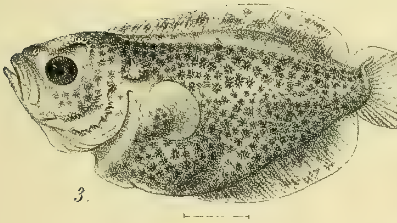
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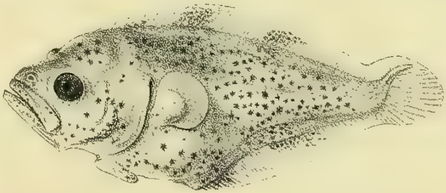
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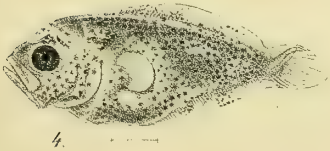
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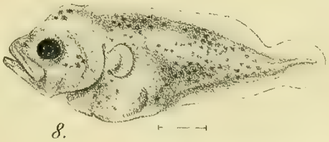
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Trykt hos V Winkel & Magnussen

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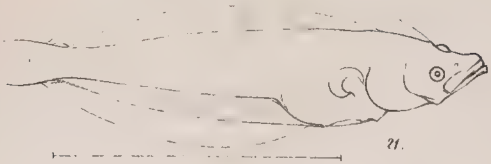

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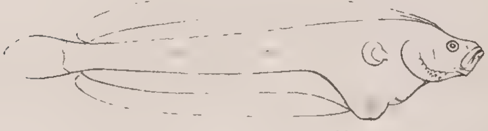

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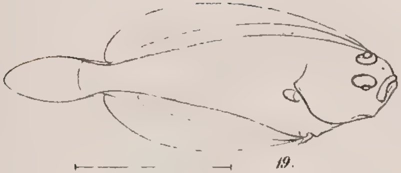

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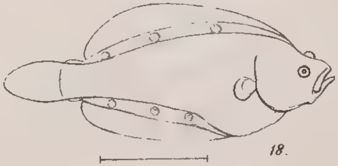

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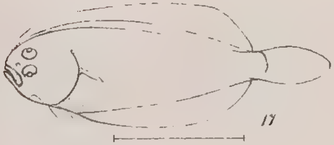

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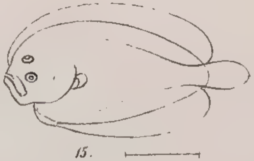

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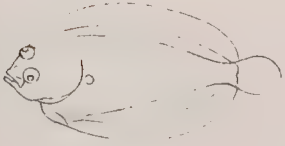

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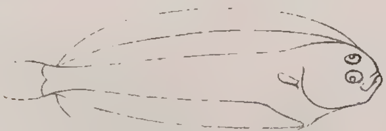

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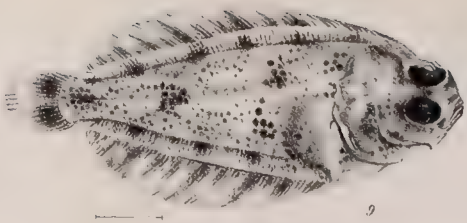

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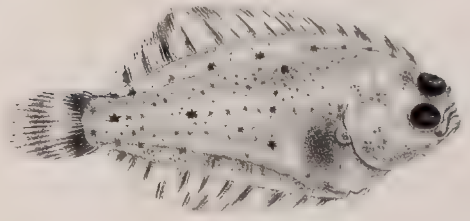

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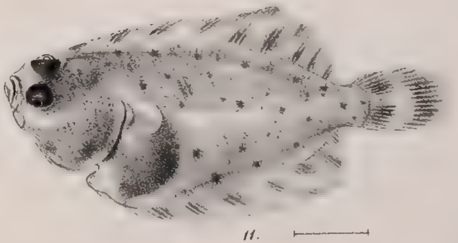

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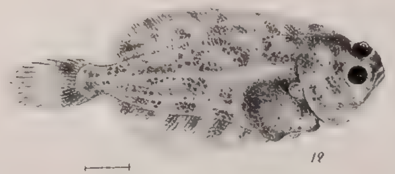

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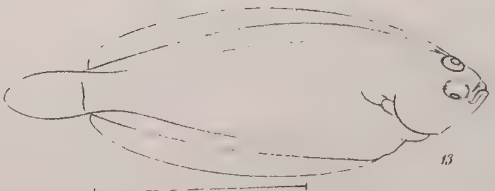

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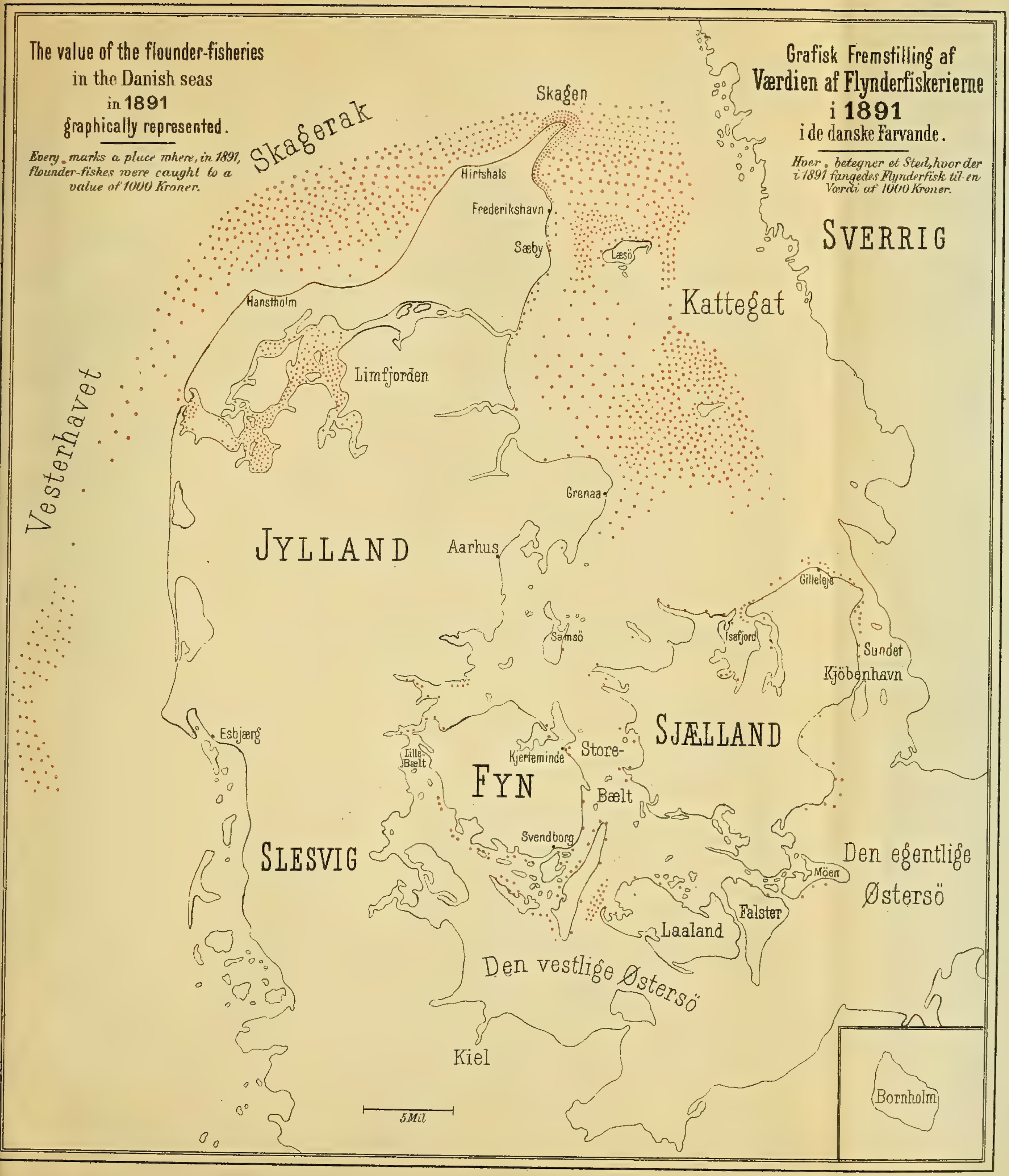
C Gordts efter Nat. tegnet og lith

Trykt hos V Winkel & Magnussen



The value of the flounder-fisheries
in the Danish seas
in 1891
graphically represented.

Every . marks a place where, in 1891, flounder-fishes were caught to a value of 1000 Kroner.

Grafisk Fremstilling af
Værdien af Flynderfiskerierne
i 1891
i de danske Farvande.

Hver . betegner et Sted, hvor der i 1891 fangedes Flynderfisk til en Værdi af 1000 Kroner.

Tabel I.

Røds

Skagens Sø

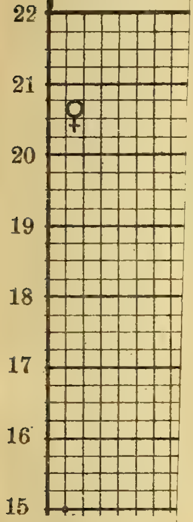
20.—28. Ja

Storm. Sn

(Seine w. la

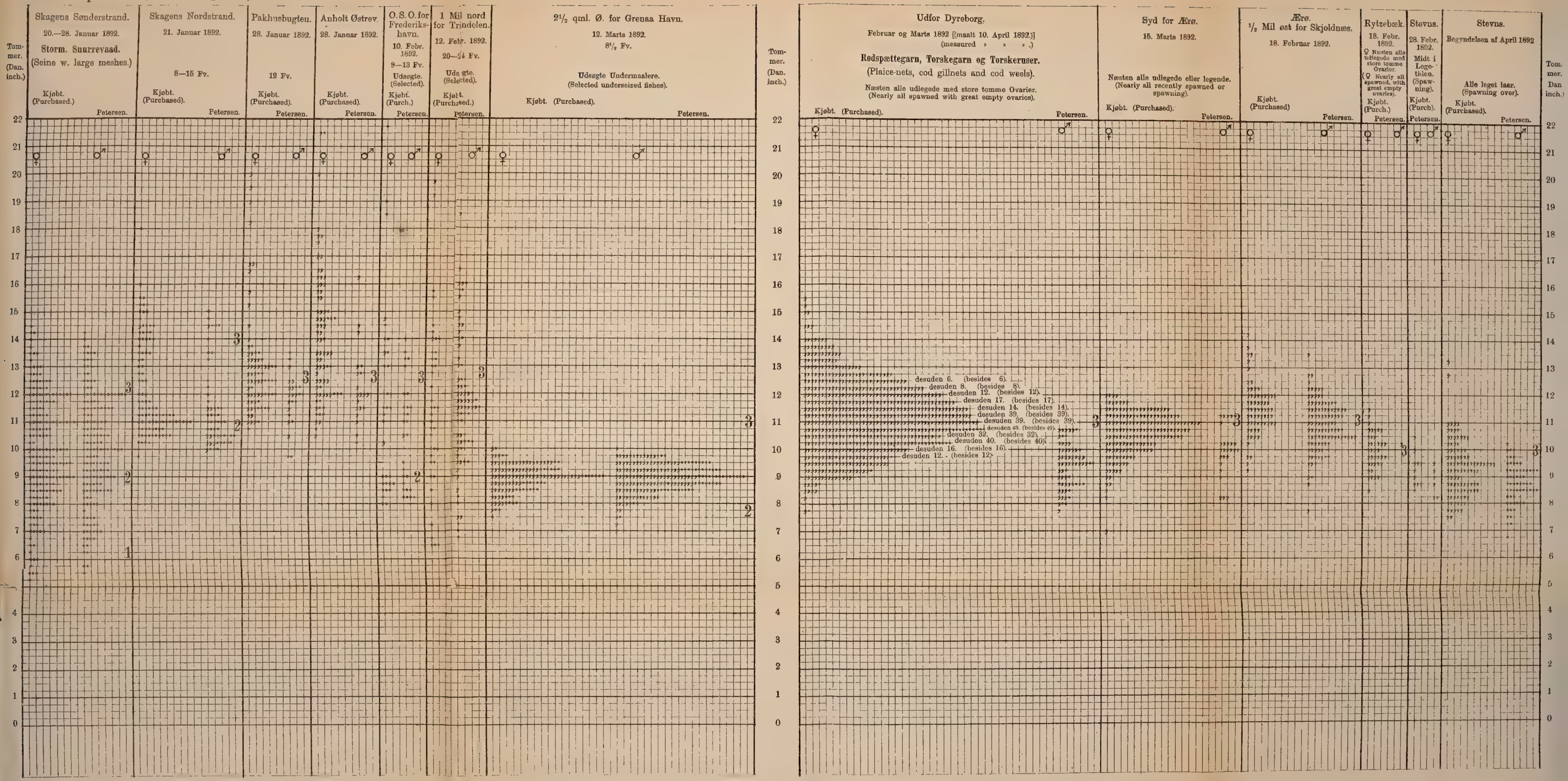
Tommer. (Dan. inch.)

Kjøbt. (Purchased.)



Tabel I.

Rødspætter. *(Pleuronectes platessa).*



Tabel II.

Rødspætter. *(Pleuronectes plates*

Fæn

Tommer. (Dan. inch.)

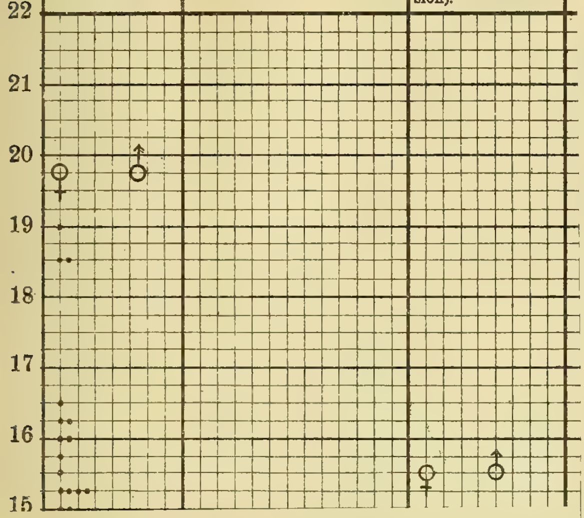
25. Mai 1891. — **8. Juni 1892.**

Stormasket Snurrevaad.
(Seine with large meshes).

Petersen.

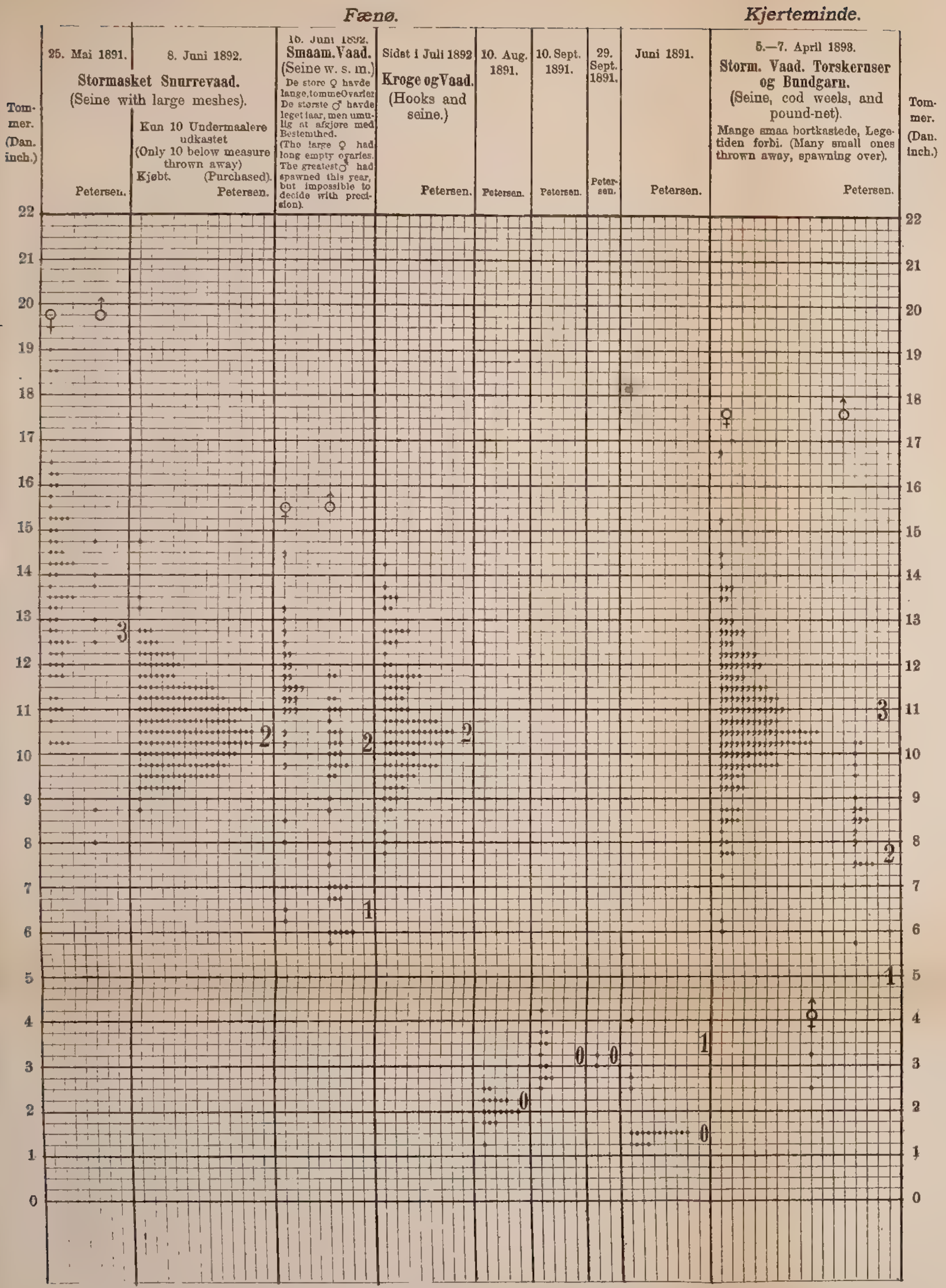
Kun 10 Undermaalere udkastet
(Only 10 below measure thrown away)
Kjøbt. (Purchased).
Petersen.

15. Juni 1892.
Smaam. Vaad.
(Seine w. s. m.)
De store ♀ havde lange, tomme Ovarier. De største ♂ havde leget iaar, men umulig at afgjøre med Bestemthed.
(The large ♀ had long empty ovaries. The greatest ♂ had spawned this year, but impossible to decide with precision).



Tabel II.

Rødspætter. *(Pleuronectes platessa)*



Fænø.

25. Mai 1891. **Stormasket Snurrevaad.** (Seine with large meshes). Petersen.

8. Juni 1892. Kun 10 Undermaalere udkastet (Only 10 below measure thrown away) Kjøbt. (Purchased). Petersen.

16. Juni 1892. **Smaam. Vaad.** (Seine w. s. m.) De store ♀ havde lange, tomme Ovarier. De største ♂ havde leget iaar, men umulig at afgjøre med Bestemthed. (The large ♀ had long empty ovaries. The greatest ♂ had spawned this year, but impossible to decide with precision).

Sidst i Juli 1892. **Kroge og Vaad.** (Hooks and seine.) Petersen.

10. Aug. 1891. Petersen.

10. Sept. 1891. Petersen.

29. Sept. 1891. Petersen.

Kjerteminde.

Juni 1891. Petersen.

5.—7. April 1893. **Storm. Vaad. Torskeruser og Bundgarn.** (Seine, cod weels, and pound-net). Mange smaa bortkastede, Legetiden forbi. (Many small ones thrown away, spawning over). Petersen.

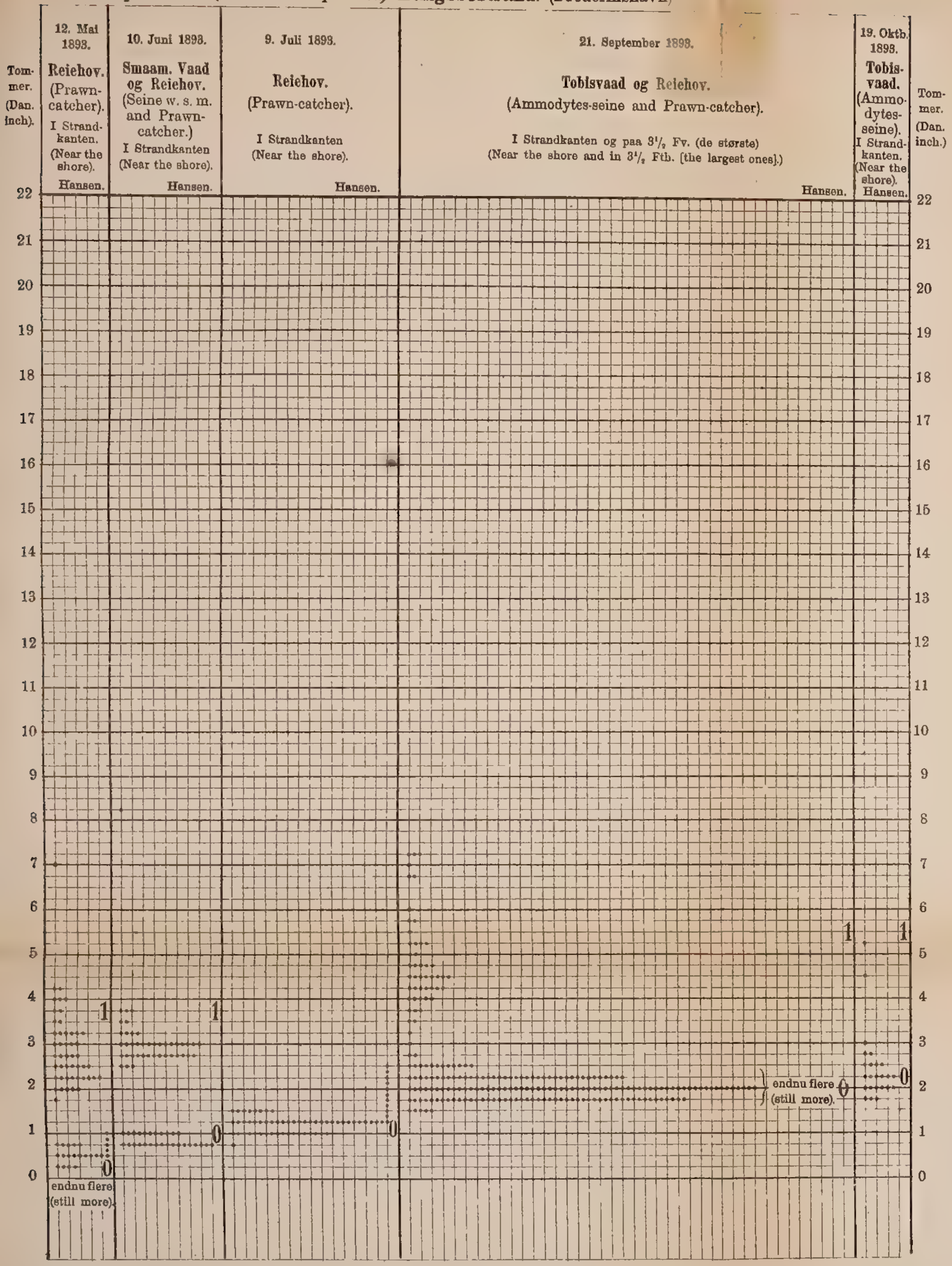
Tabel III.

Rødspætter. *(Pleuronectes platessa)*

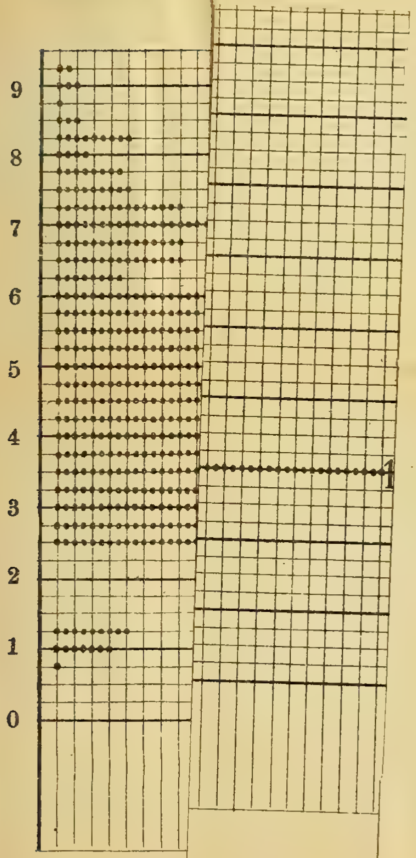
Tommer. (Dan. inch).	12. Mai 1893. **Reiehov.** (Prawn-catcher). I Strandkanten. (Near the shore). Hansen.	10. Juni 1893. **Smaam. Vaad og Reiehov.** (Seine w. s. m. and Prawn-catcher.) I Strandkanten (Near the shore). Hansen.	9. Juli 1893. **Reiehov.** (Prawn-catcher). I Strandkanten (Near the shore). Hansen.
22			
21			
20			
19			
18			
17			
16			
15			

Tabel III.

Rødspætter. *(Pleuronectes platessa)* Bangsbostrand. (Frederikshavn)

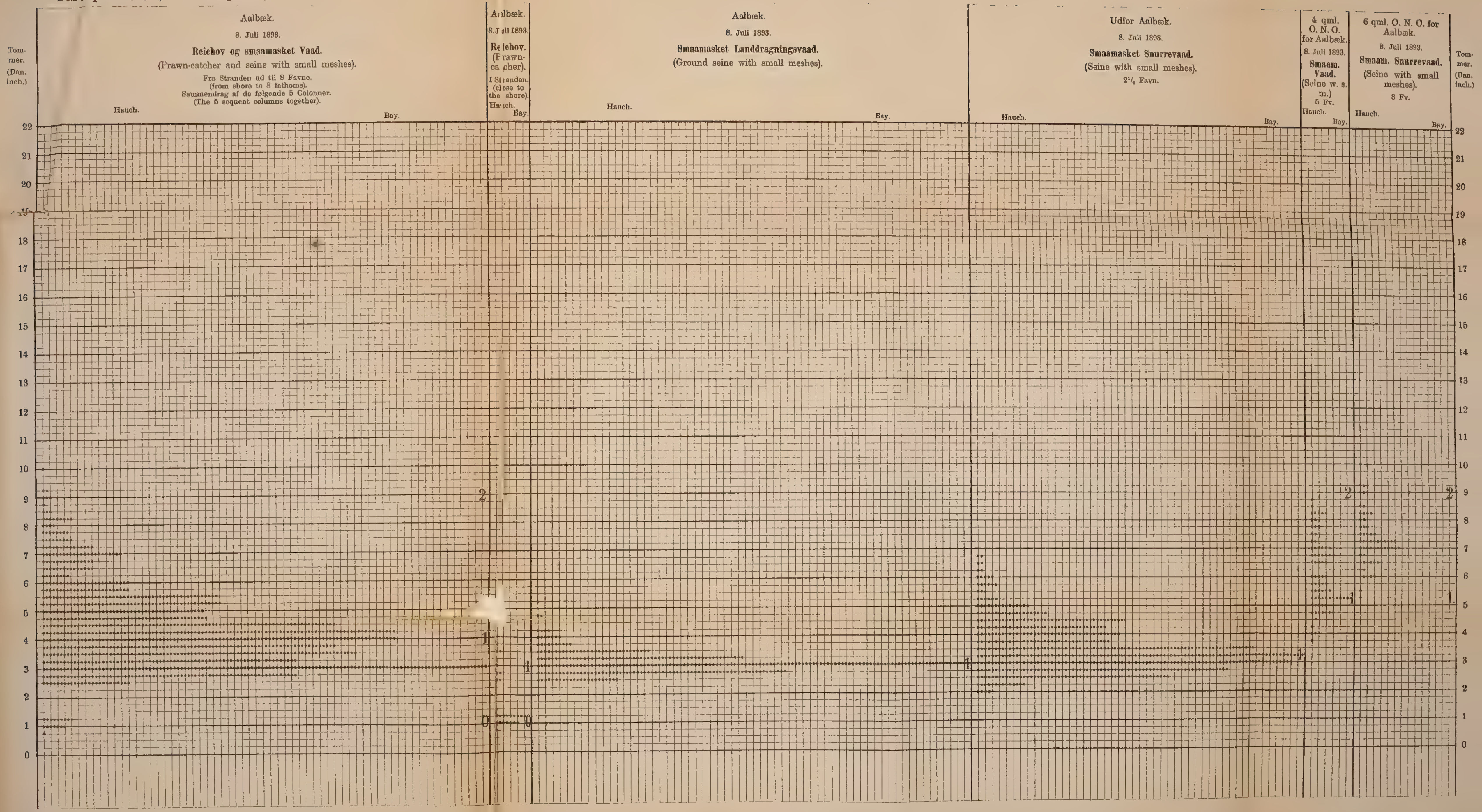


Tabel VIII.



Tabel IV.

Rødspætter. *(Pleuronectes platessa).*



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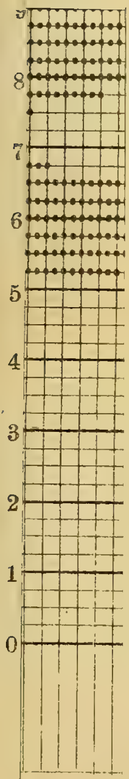
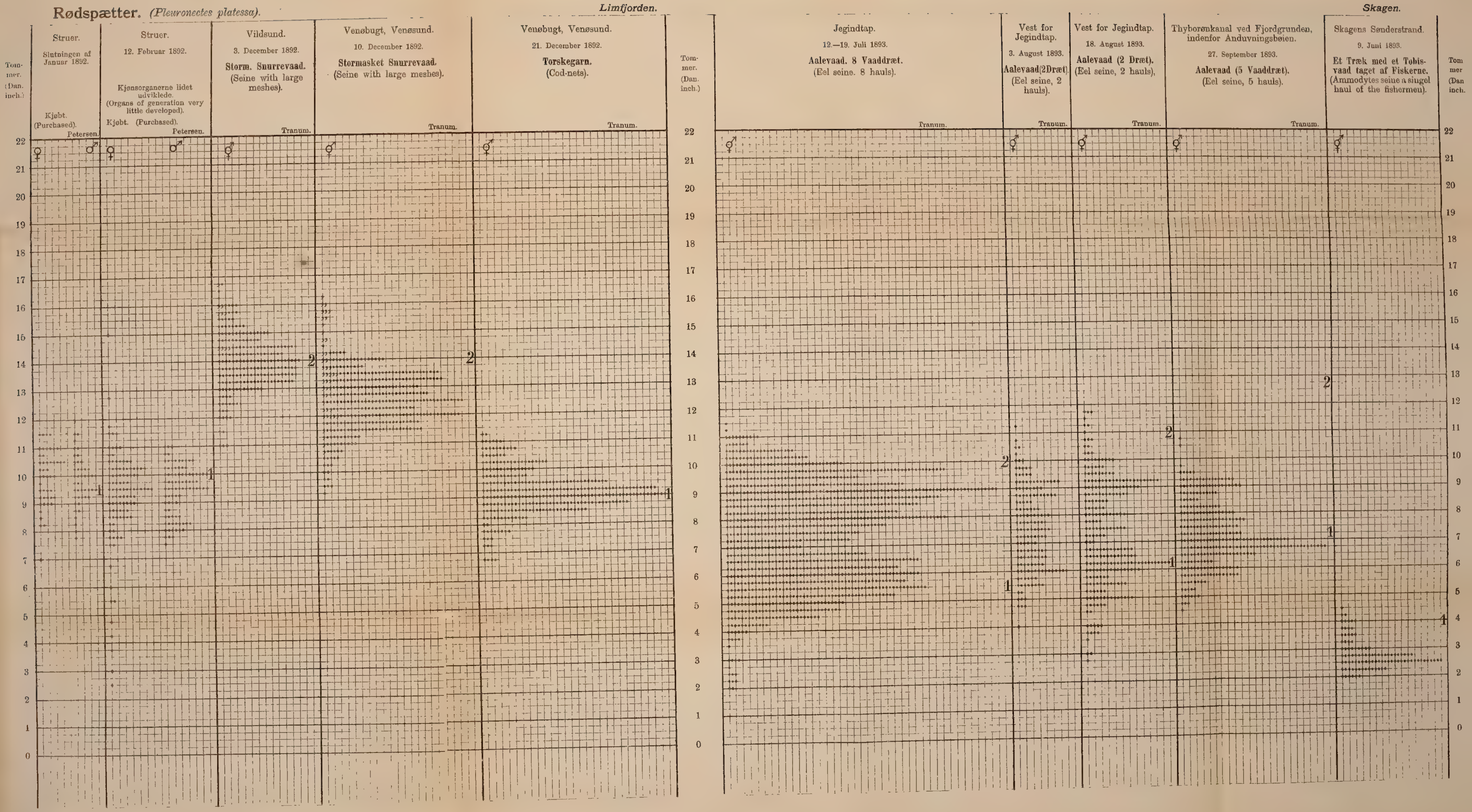


Tabel V.

Rødspætter. *(Pleuronectes platessa).*



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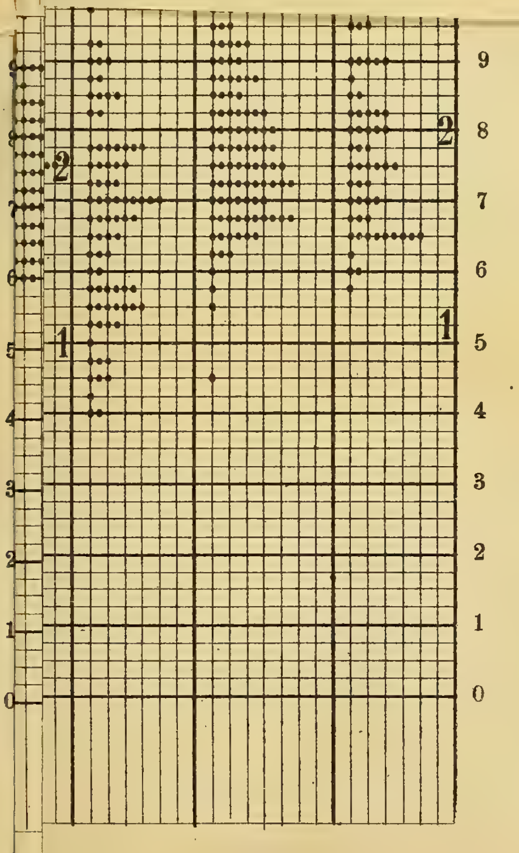
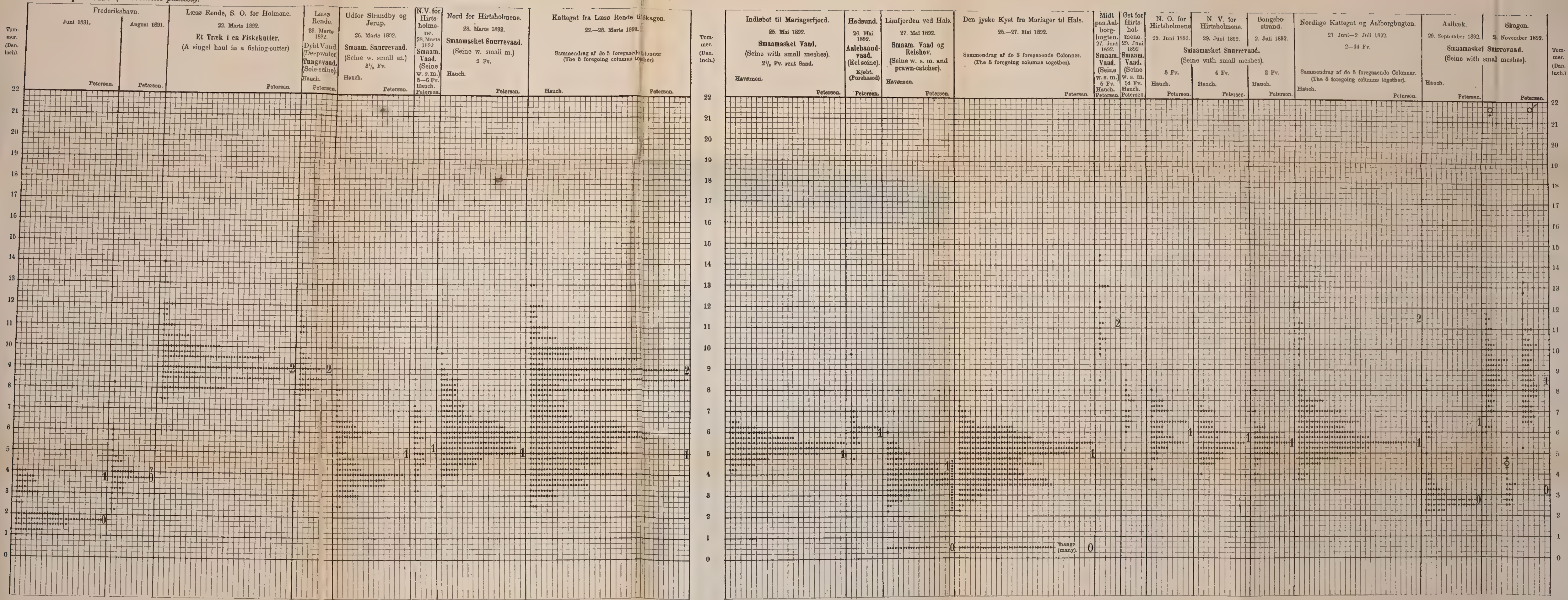


Tabel VI.

Rødspætter. *(Pleuronectes platessa).*



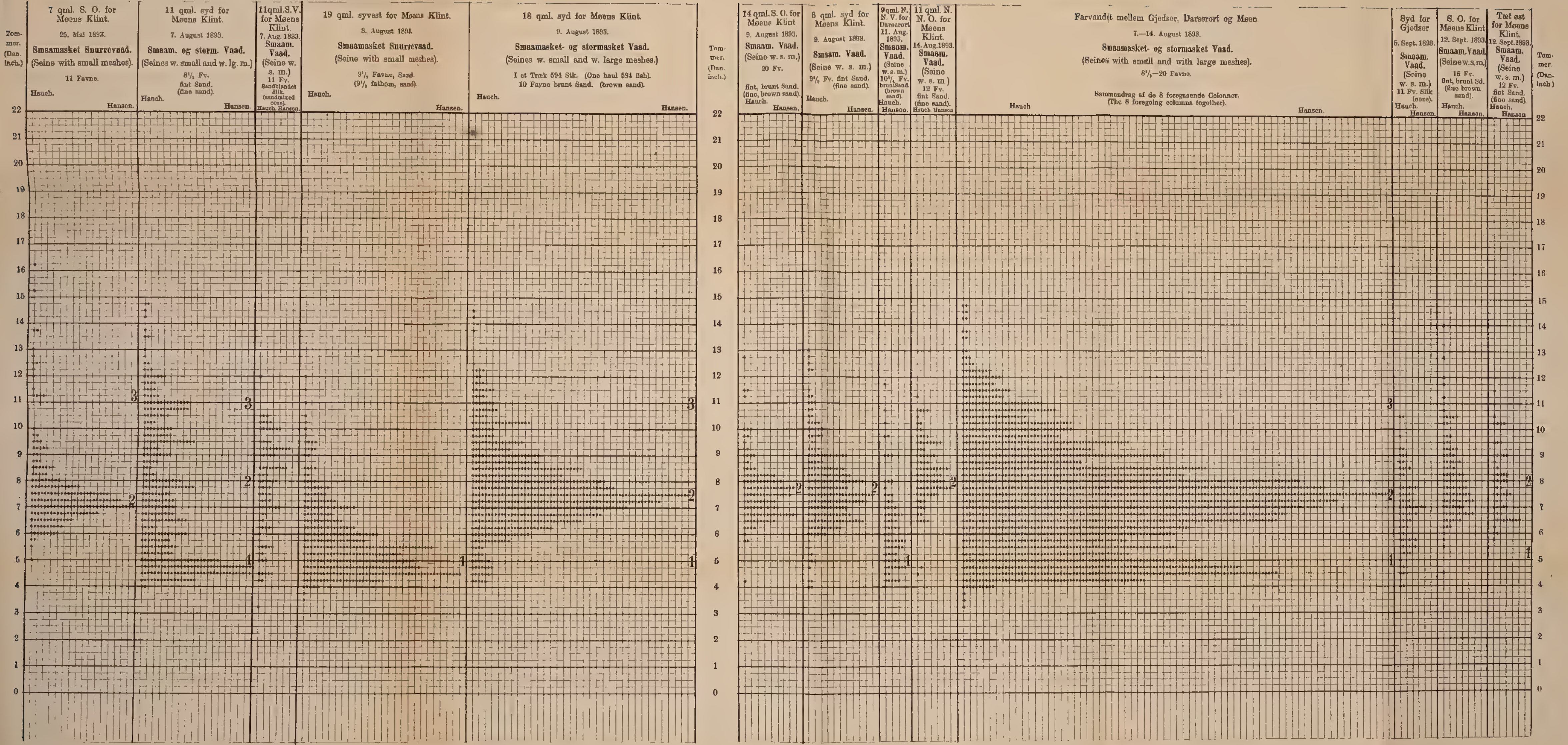
Tabel VIII.

Rødspætter. *(Pleuronectes platessa).* **Bornholm.**

Tommer. (Dan. inch).	Udfor Nexø. 7. April 1893. **Sættegarn.** (Gill nets). 8 Fv. — Legetiden forbi. (Spawning over). Hauch. Hansen.	Hasle, Hammeren, Nexø. 25. — 28. Mai 1893. **Garn og Vaad.** (Gill nets and seine). Hauch. Hansen.	Dueodden. 29. Mai 1893. **Smaa- & storm. Vaad.** (Seines w. small and large meshes). 18 Fv. Hauch. Hansen.	Dueodden 29. Mai 1893. **Sm.& storm. Vaad.** (Seines w. s. and large m.) 24. Fv. Hauch. Hansen.	**Sm. og** (Seines nets, Samme (The 3 f Hauch.
22					
21					
20					
19					
18					
17					
16					
15					

Tabel VII.

Rødspætter. *(Pleuronectes platessa).* *Den egentlige Østersø.*



7 qml. S. O. for Møens Klint.
25. Mai 1893.
Smaamasket Snurrevaad.
(Seine with small meshes).
11 Favne.
Hauch. Hansen.

11 qml. syd for Møens Klint.
7. August 1893.
Smaam. og storm. Vaad.
(Seines w. small and w. lg. m.)
8½ Fv.
fint Sand.
(fine sand).
Hauch. Hansen.

11qml. S. V. for Møens Klint.
7. Aug. 1893.
Smaam. Vaad.
(Seine w. s. m.)
11 Fv.
Sandblandet Slik.
(sandmixed ooze).
Hauch. Hansen.

19 qml. syvest for Møens Klint.
8. August 1893.
Smaamasket Snurrevaad.
(Seine with small meshes).
9½ Favne, Sand.
(9½ fathom, sand).
Hauch. Hansen.

18 qml. syd for Møens Klint.
9. August 1893.
Smaamasket- og stormasket Vaad.
(Seines w. small and w. large meshes.)
I et Træk 594 Stk. (One haul 594 fish).
10 Favne brunt Sand. (brown sand).
Hauch. Hansen.

14 qml. S. O. for Møens Klint
9. August 1893.
Smaam. Vaad.
(Seine w. s. m.)
20 Fv.
fint, brunt Sand.
(fine, brown sand).
Hauch. Hansen.

6 qml. syd for Møens Klint.
9. August 1893.
Smaam. Vaad.
(Seine w. s. m.)
9½ Fv. fint Sand.
(fine sand).
Hauch. Hansen.

9 qml. N. N. V. for Darserort
11. Aug. 1893.
Smaam. Vaad.
(Seine w. s. m.)
10¾ Fv.
brunt Sand.
(brown sand).
Hauch. Hansen.

11 qml. N. N. O. for Møens Klint.
14. Aug. 1893.
Smaam. Vaad.
(Seine w. s. m.)
12 Fv.
fint Sand.
(fine sand).
Hauch. Hansen

Farvandet mellem Gjedser, Darserort og Møen
7.—14. August 1893.
Smaamasket- og stormasket Vaad.
(Seines with small and with large meshes).
8½—20 Favne.
Sammendrag af de 8 foregaaende Colonner.
(The 8 foregoing columns together).
Hauch Hansen.

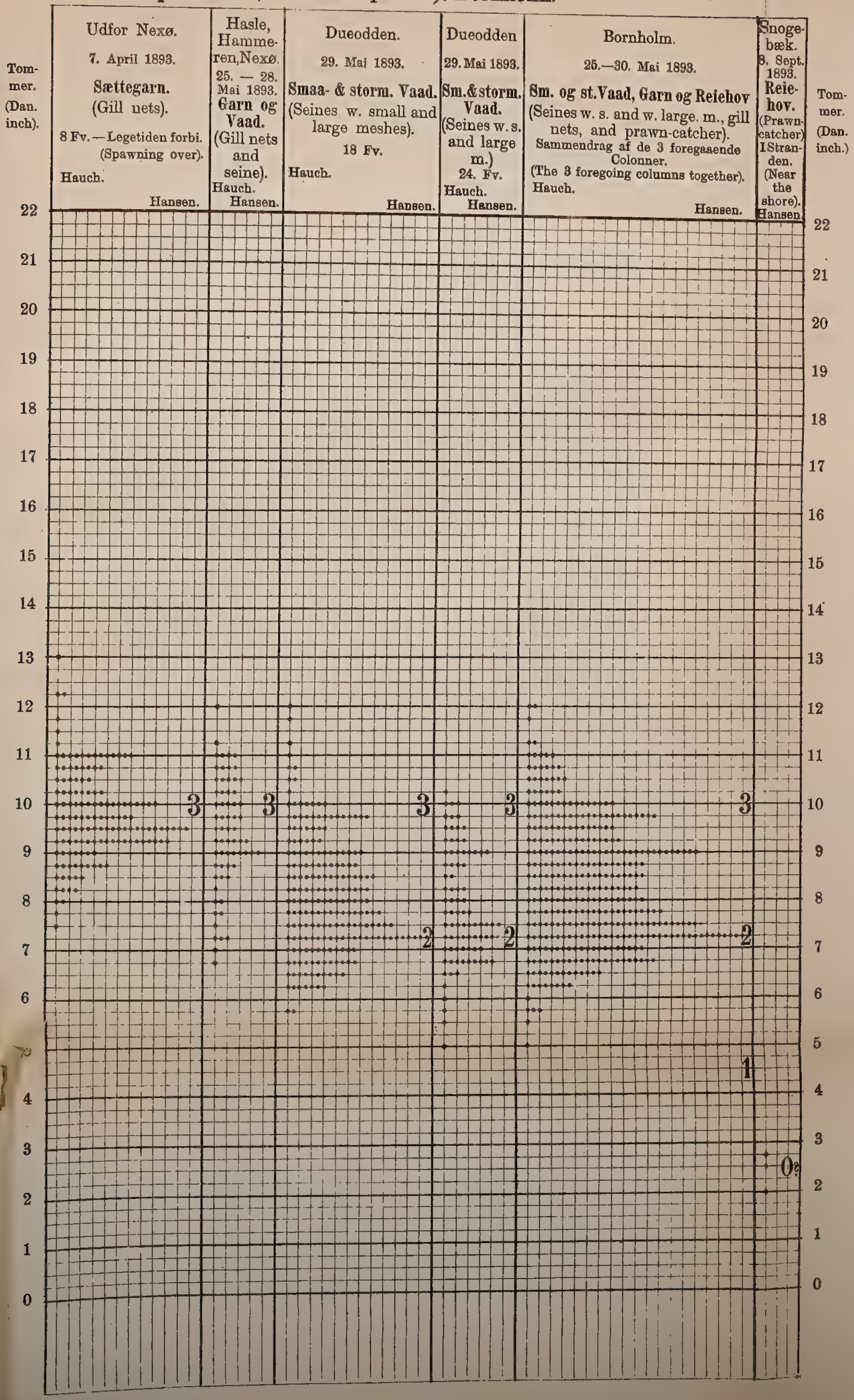
Syd for Gjedser
5. Sept. 1893.
Smaam. Vaad.
(Seine w. s. m.)
11 Fv. Slik (ooze).
Hauch. Hansen.

S. O. for Møens Klint
12. Sept. 1893.
Smaam. Vaad.
(Seine w. s. m.)
16 Fv.
fint, brunt Sd.
(fine brown sand).
Hauch. Hansen.

Tæt øst for Møens Klint.
12. Sept. 1893.
Smaam. Vaad.
(Seine w. s. m.)
12 Fv.
fint Sand.
(fine sand).
Hauch. Hansen

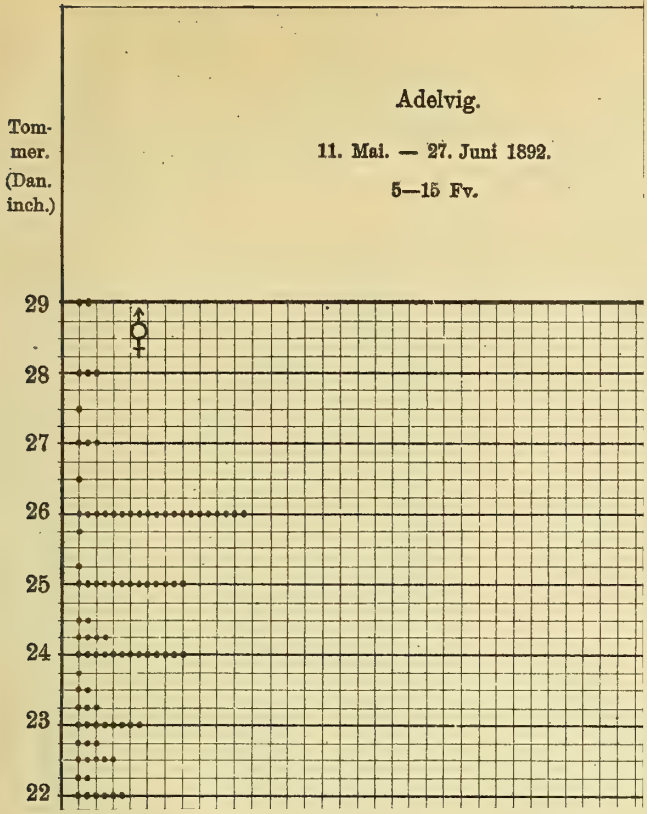
Tabel VIII.

Rødspætter. *(Pleuronectes platessa)*. Bornholm.



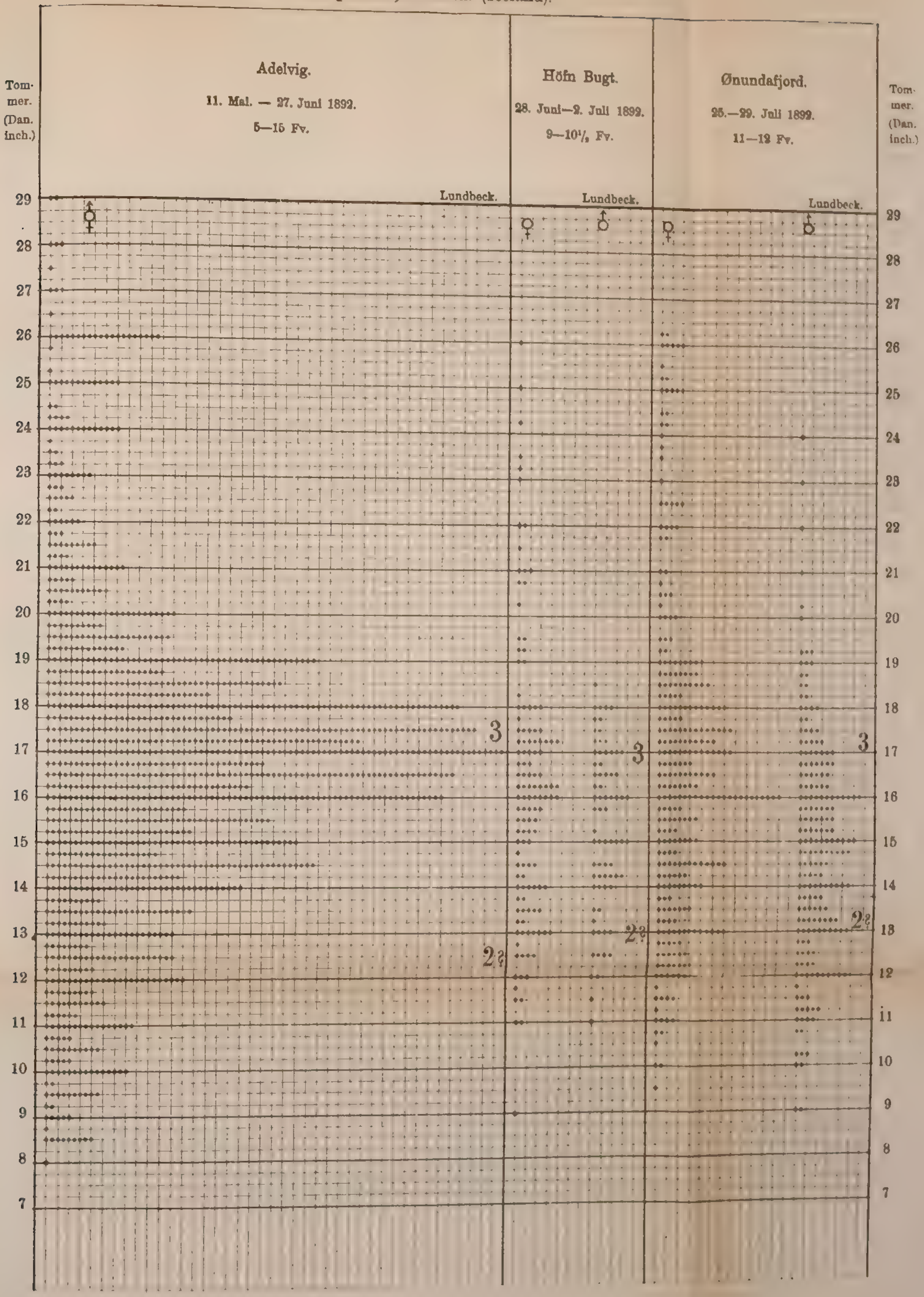
Tabel IX.

Rödspætter. *(Pleuronectes platessa)*



Tabel IX.

Rödspætter. *(Pleuronectes platessa)* ***Island.*** (Iceland).



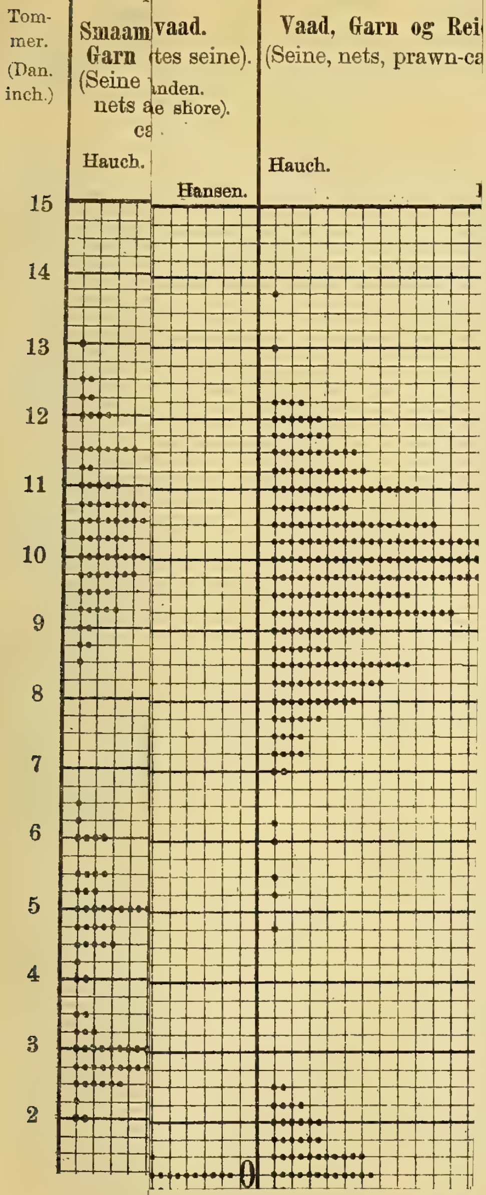
Tabel

S

Nordli
(Mariag
23. Ap
Smaam
Garn
(Seine
nets a
ca
Hauch.

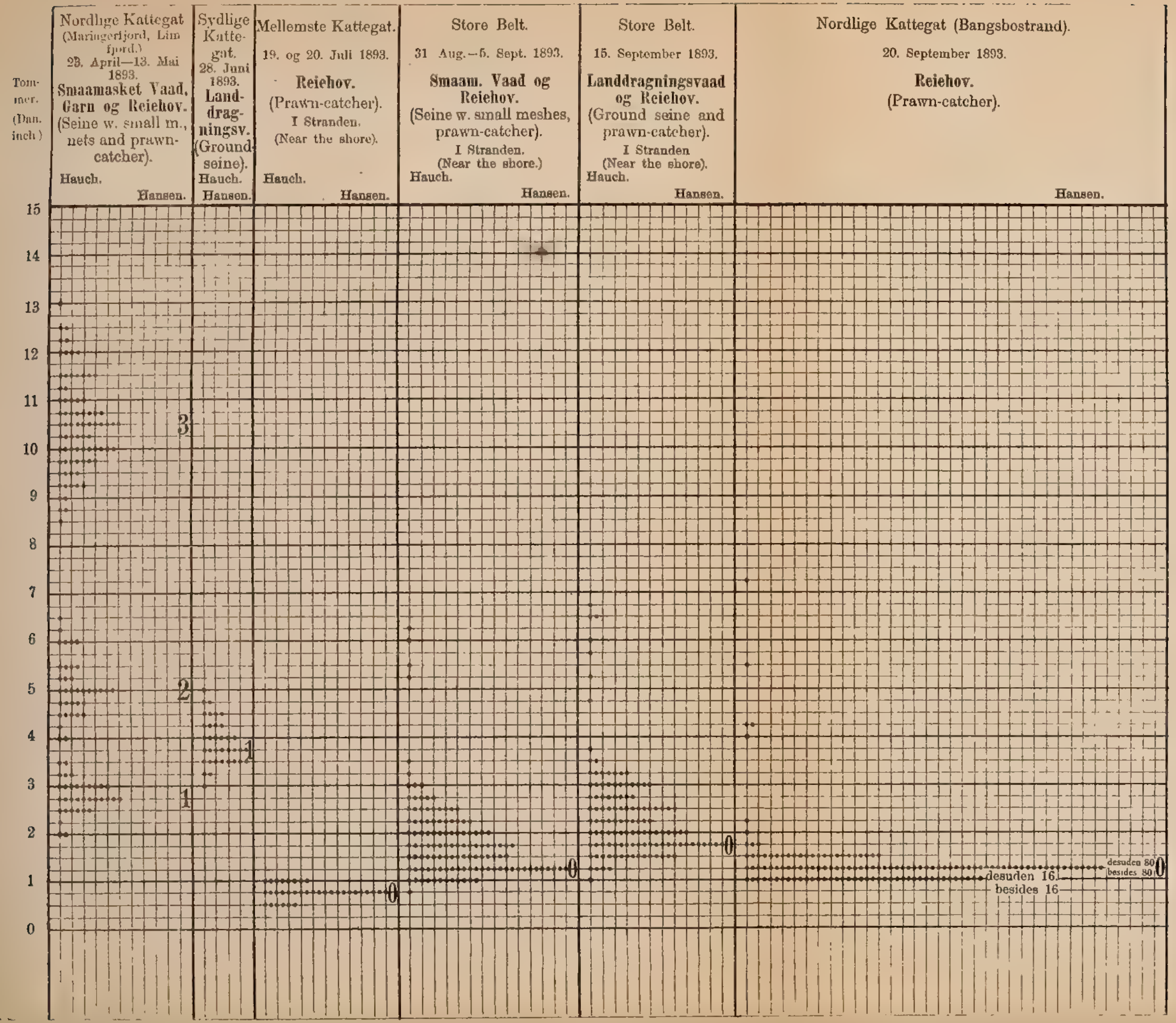
Kattegat.
ber 1893.
vaad.
tes seine).
nden.
e shore).
Hansen.

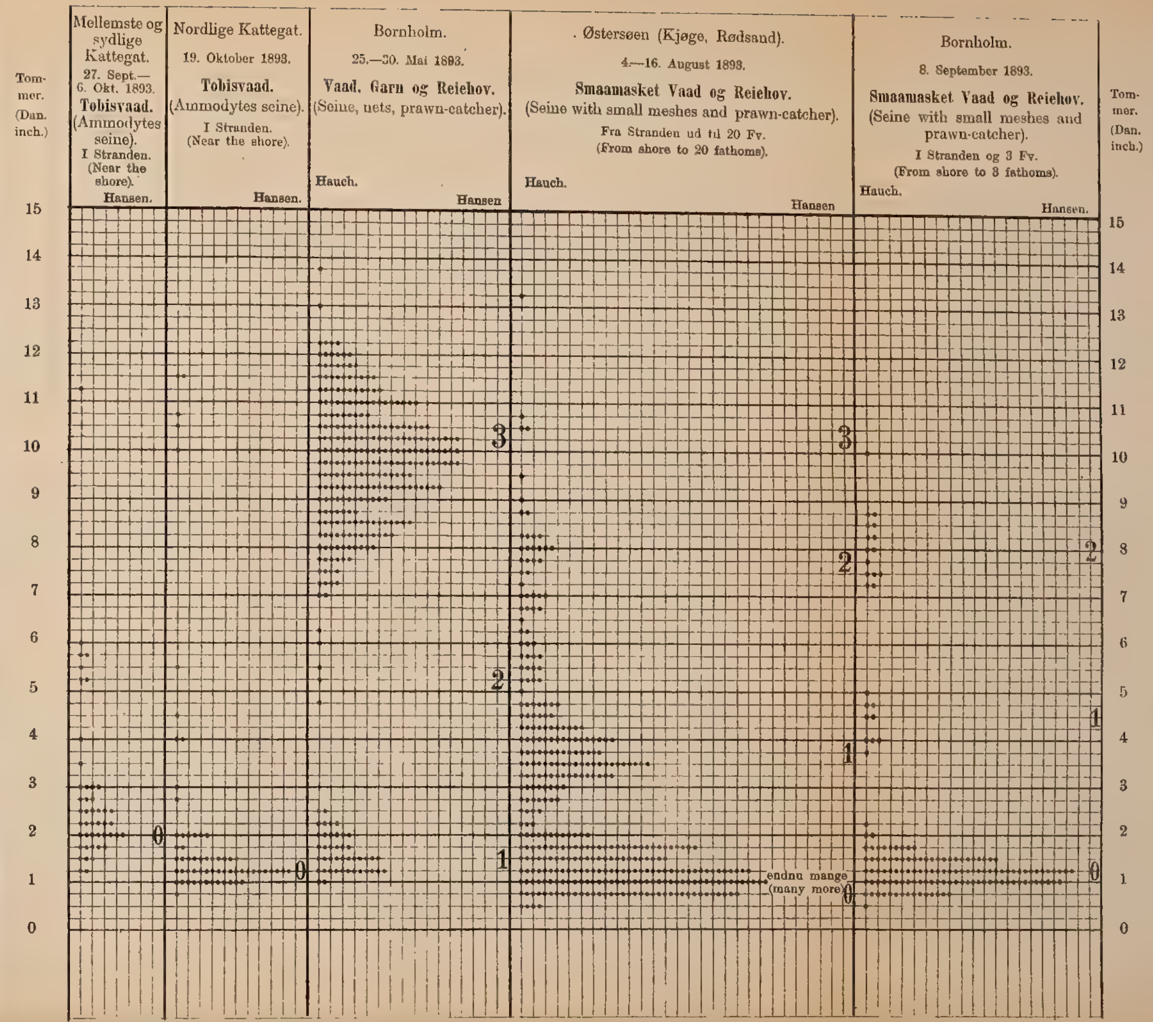
Bornholm.
25.—30. Mai 1893
Vaad, Garn og Rei
(Seine, nets, prawn-ca
Hauch.



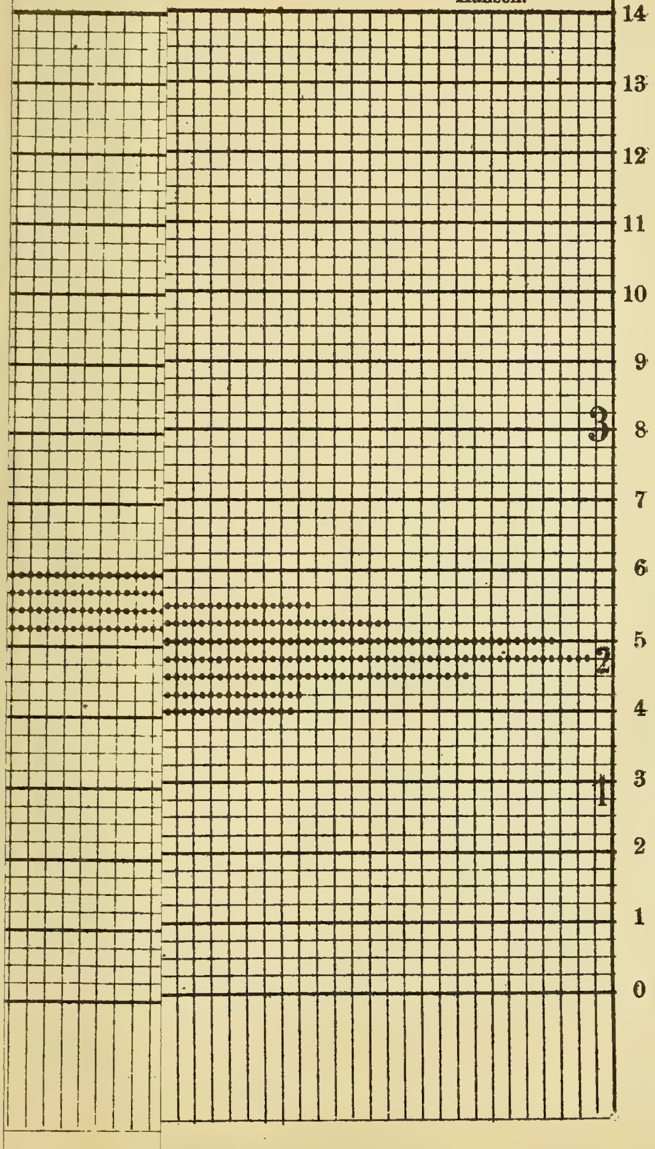
Tabel X.

Skrubben. *(Pleuronectes flesus).*



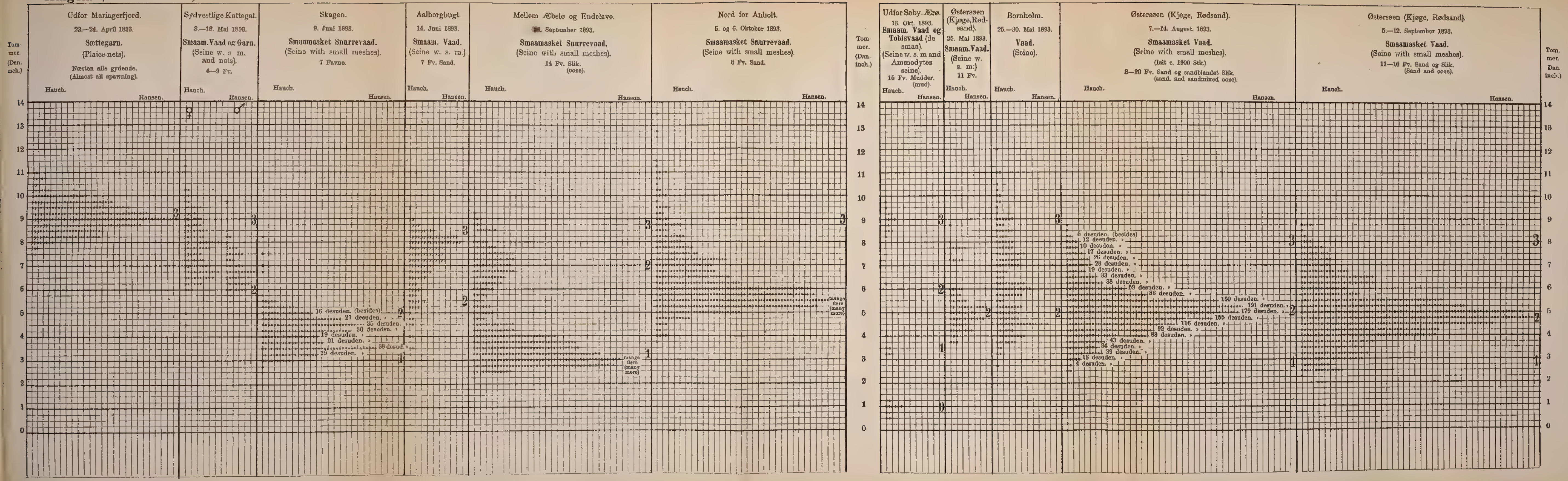


To	for Anholt.	n (Kjøge, Rødsand).	
m	Oktober 1893.	2. September 1893.	
(D	et Snurrevaad.	aamasket Vaad.	Tom.
in	small meshes	with small meshes).	mer.
	v. Sand.	6 Fv. Sand og Slik. (Sand and ooze).	Dan. inch.)
		Hansen.	



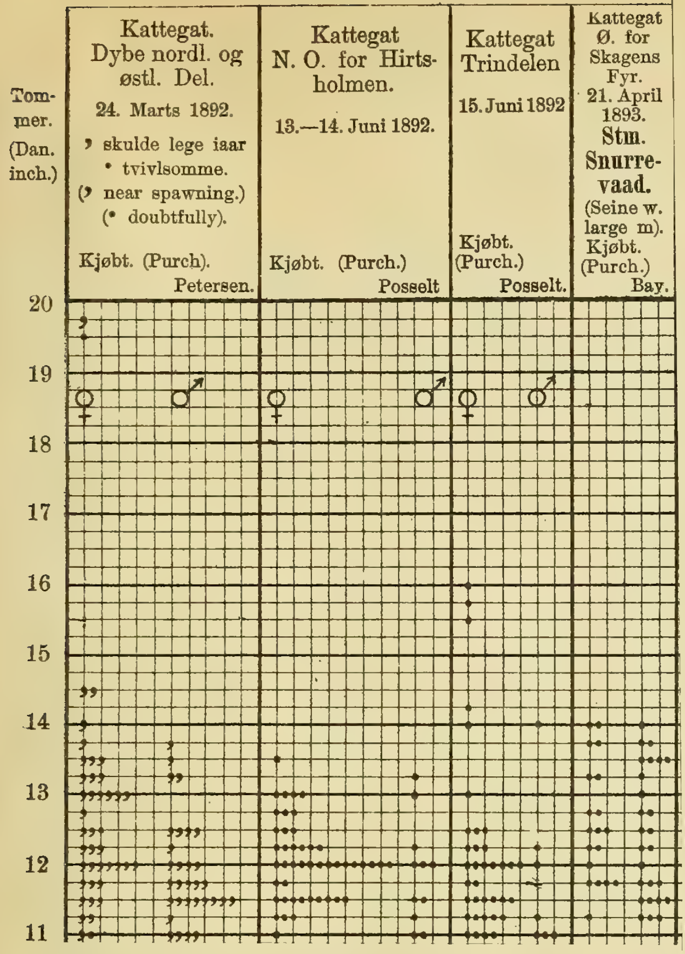
Tabel XI.

Isingen. *(Pleuronectes limanda).*



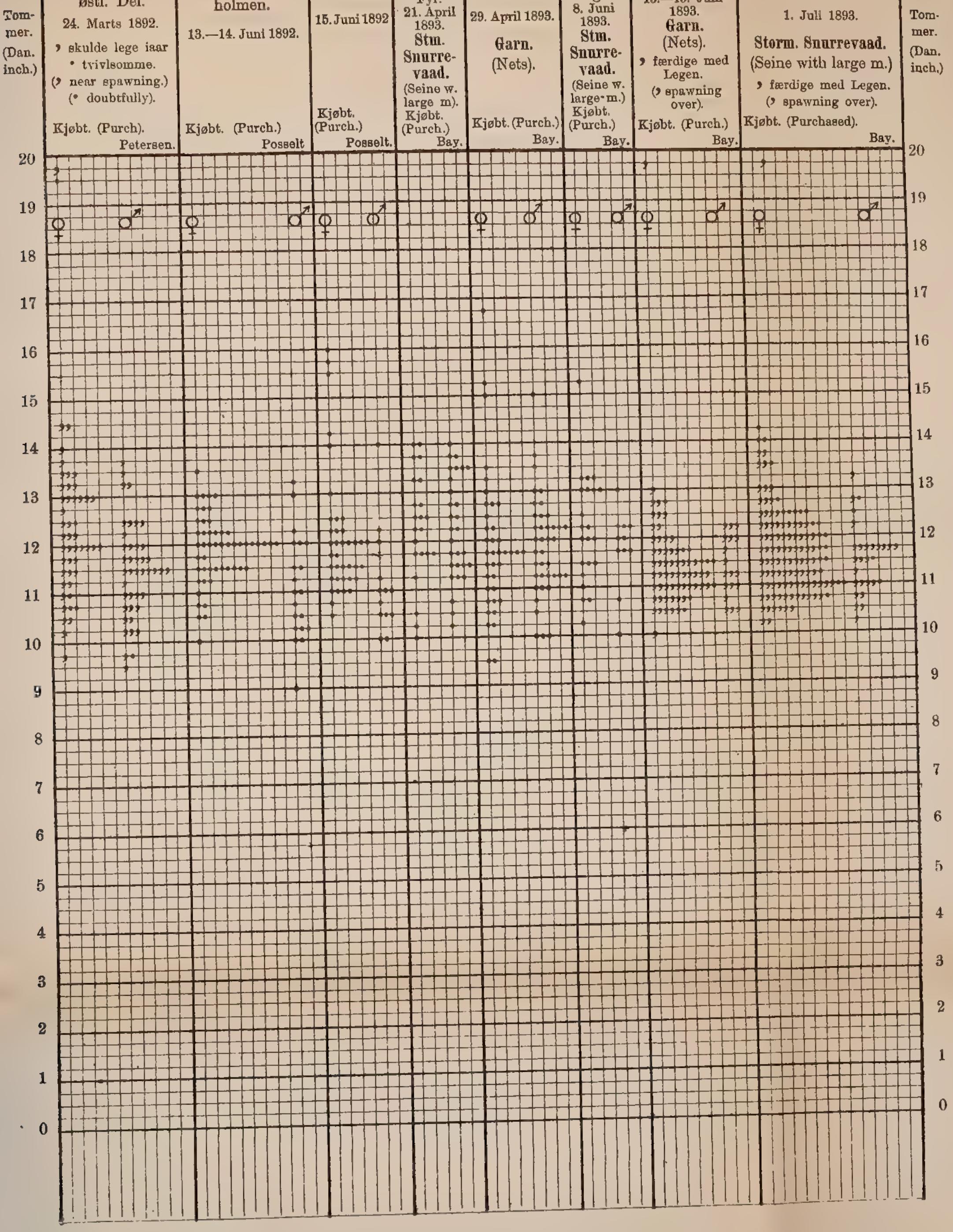
Tabel XII.

Rødtungen. *(Pl. microcephalus).*



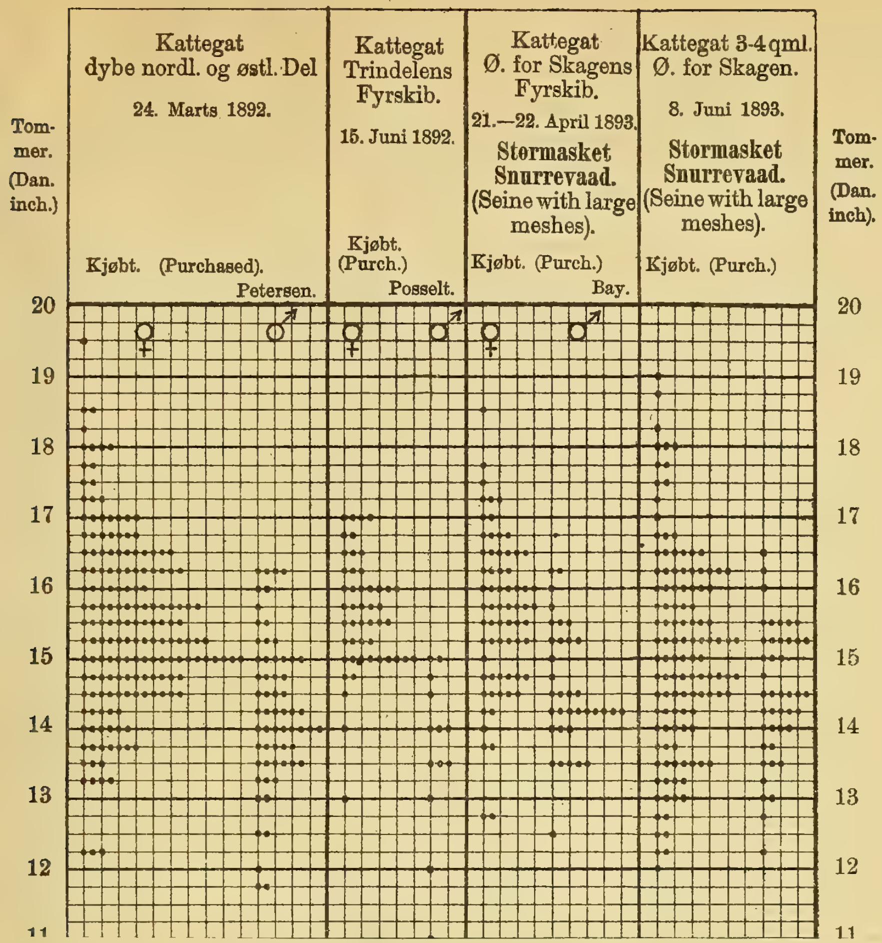
Rødtungen. *(Pl. microcephalus).*

Kattegat. Dybe nordl. og østl. Del. 24. Marts 1892. › skulde lege iaar • tvivlsomme. (› near spawning.) (• doubtfully). Kjøbt. (Purch). Petersen.	Kattegat N. O. for Hirtsholmen. 13.—14. Juni 1892. Kjøbt. (Purch.) Posselt	Kattegat Trindelen 15. Juni 1892 Kjøbt. (Purch.) Posselt.	Kattegat Ø. for Skagens Fyr. 21. April 1893. **Stm. Snurrevaad.** (Seine w. large m). Kjøbt. (Purch.) Bay.	Kattegat Læsø Rende 29. April 1893. **Garn.** (Nets). Kjøbt. (Purch.) Bay.	Kattegat Ø. for Skagen. 8. Juni 1893. **Stm. Snurrevaad.** (Seine w. large m.) Kjøbt. (Purch.) Bay.	Kattegat Læsø Rende. 13.—15. Juni 1893. **Garn.** (Nets). › færdige med Legen. (› spawning over). Kjøbt. (Purch.) Bay.	Skagerak N. for Skagen. 1. Juli 1893. **Storm. Snurrevaad.** (Seine with large m.) › færdige med Legen. (› spawning over). Kjøbt. (Purchased). Bay.



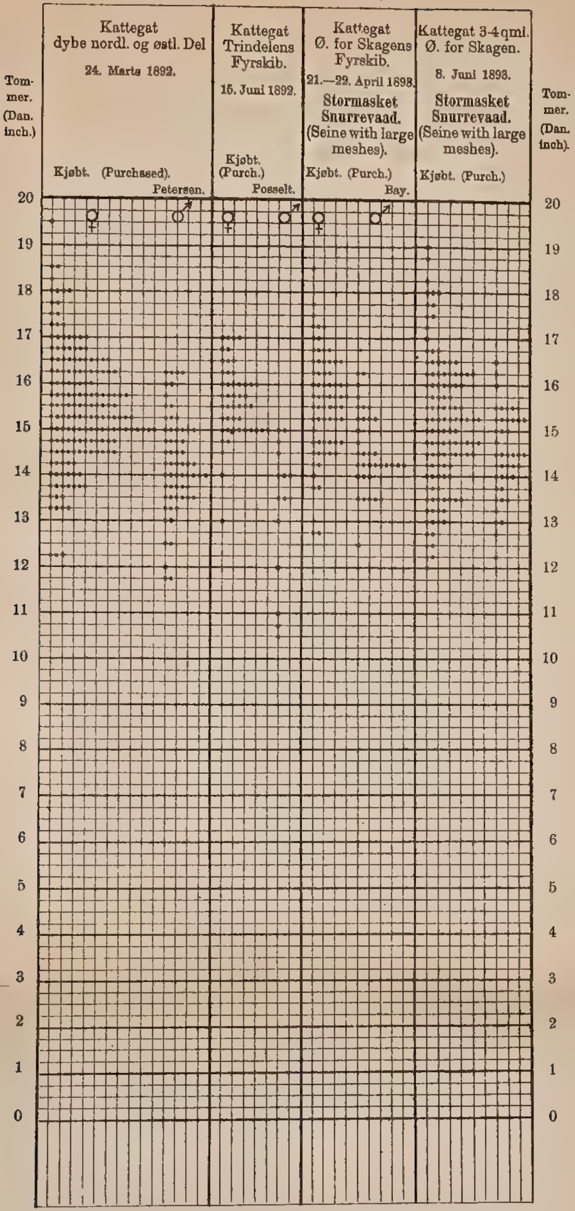
Tabel XIII.

Skærisingen. *(Pl. cynoglossus).*



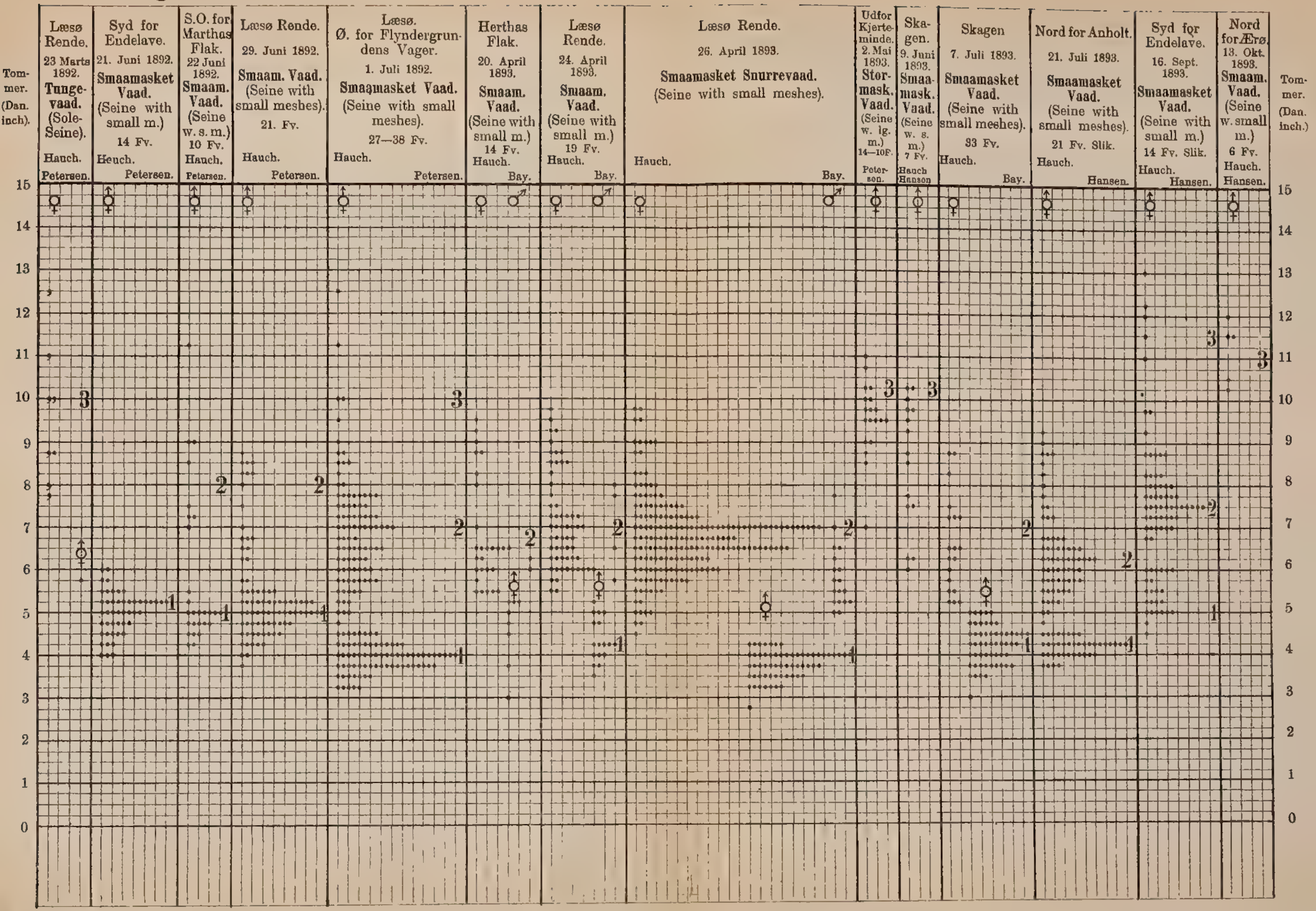
Tabel XIII.

Skærisingen. *(Pl. cynoglossus).*



Tabel XIV.

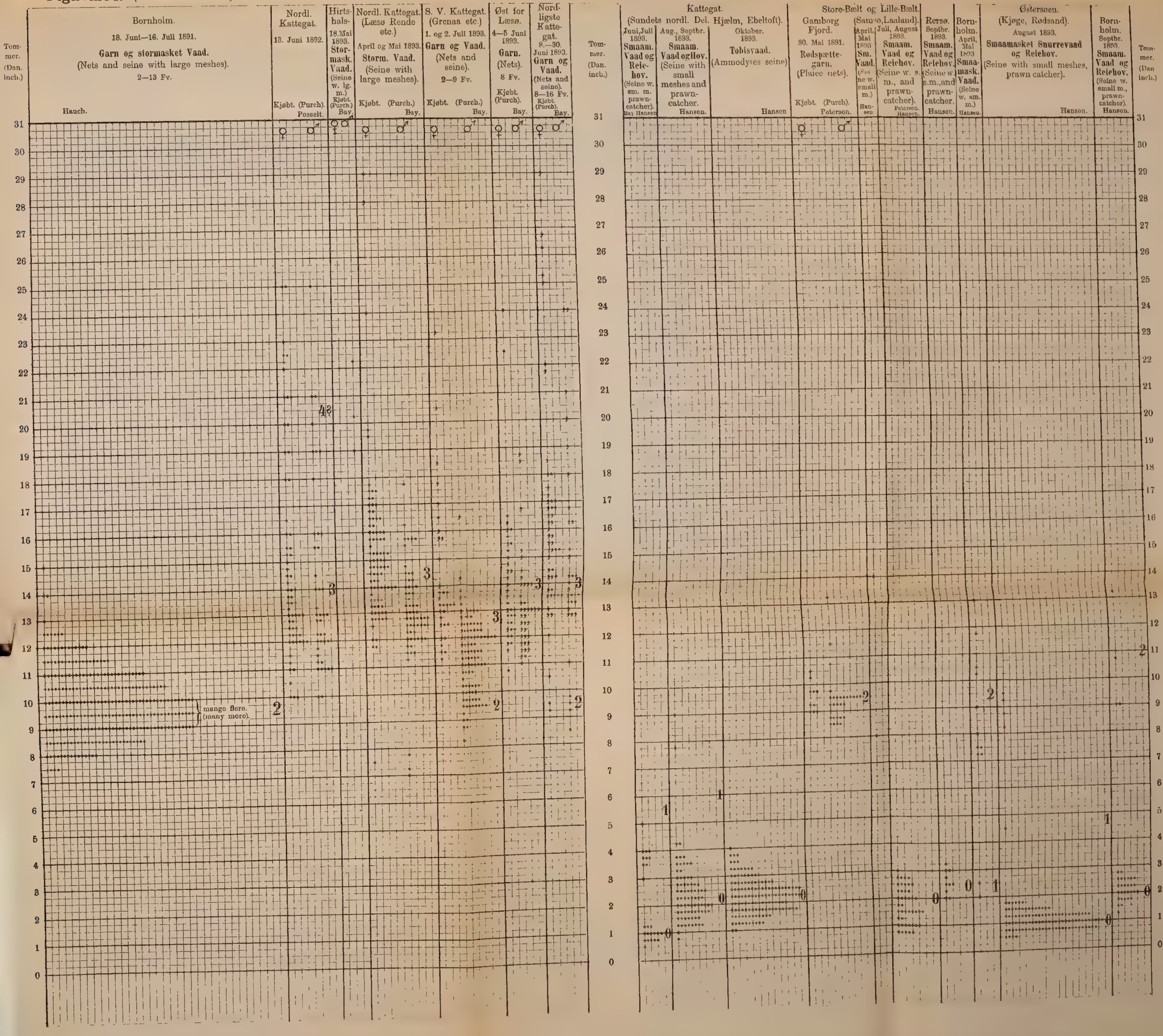
Haaisingen. *(Drepanopsetta platessoides).*



Tom me (Da inch	Lille-Bælt. sø,Laaland). Juli, August 1893. **Smaam. Vaad og Reiehov.** (Seine w. s. m., and prawn-	Rersø. Septbr. 1893. **Smaam. Vaad og Reiehov.** (Seine w. s.m.,and prawn-	Bornholm. April, Mai 1893. **Smaamask. Vaad.** (Seine	Østersøen. (Kjøge, Rødsand). August 1893. **Smaamasket Snurrevaad og Reiehov.** (Seine with small meshes, prawn-catcher).	Bornholm. Septbr. 1893. **Smaam. Vaad og Reiehov.** (Seine w. small m.,	Tommer. (Dan. inch.)

Tabel XV.

Pighvarre. *(Rhombus maximus.)*



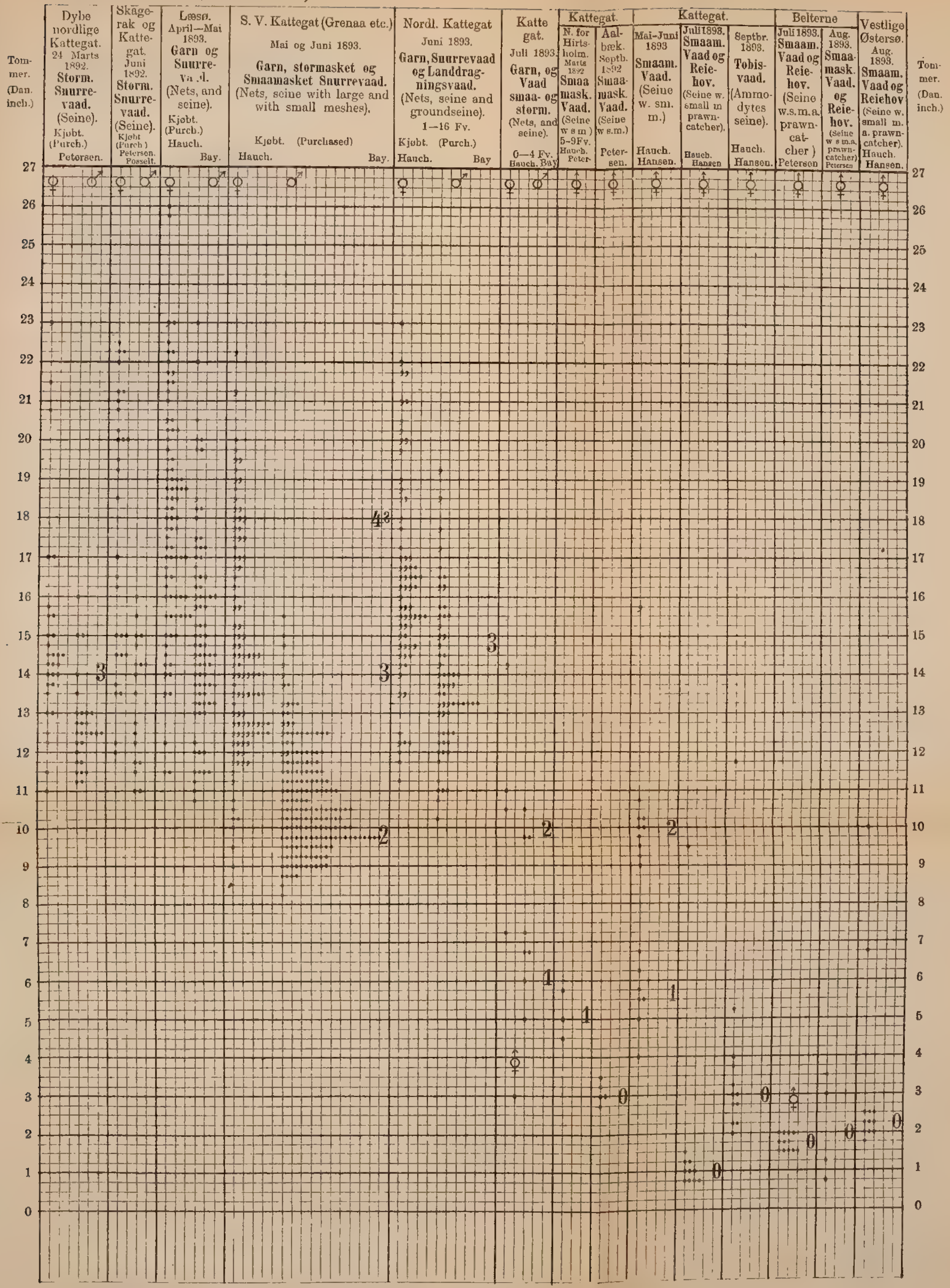
Tabel XVI.

Slethvar

Tommer. (Dan. inch.)	Dybe nordlige Kattegat. 24. Marts 1892. **Storm. Snurrevaad.** (Seine). Kjøbt. (Purch.) Petersen.		Skagerak og Kattegat. Juni 1892. **Storm. Snurrevaad.** (Seine). Kjøbt. (Purch.) Petersen. Posselt.	
	♀	♂	♀	♂
27				
26				

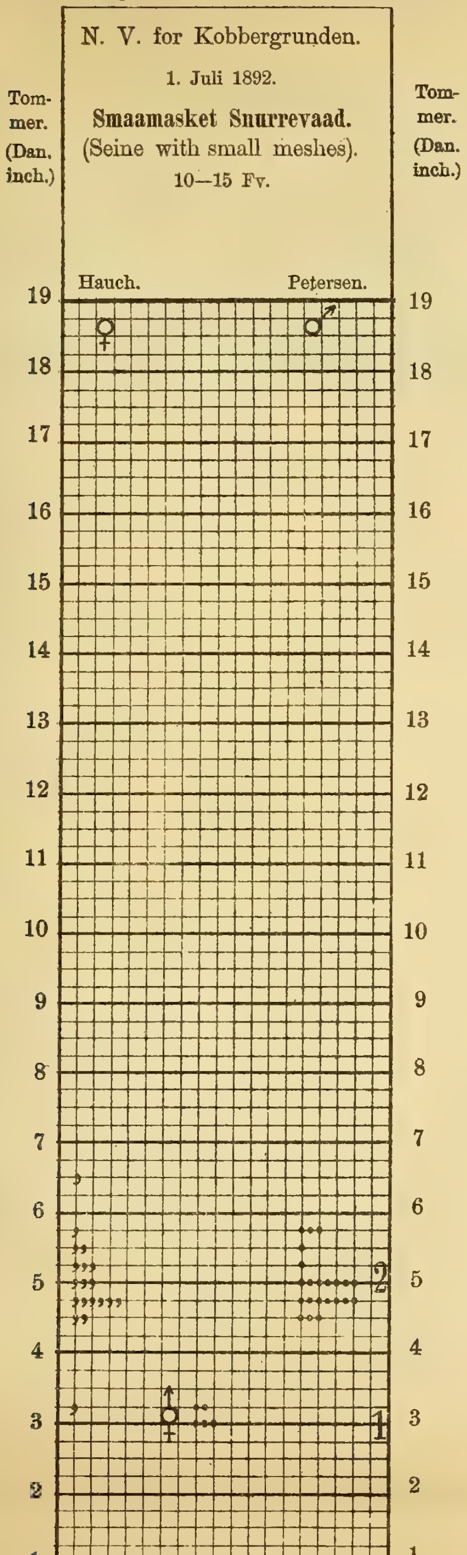
Tabel XVI.

Slethvarre. (*Rhombus laevis*).



Tabel XVII.

Arnoglossus laterna.



N. V. for Kobbergrunden.

1. Juli 1892.

Smaamasket Snurrevaad.

(Seine with small meshes).

10—15 Fv.

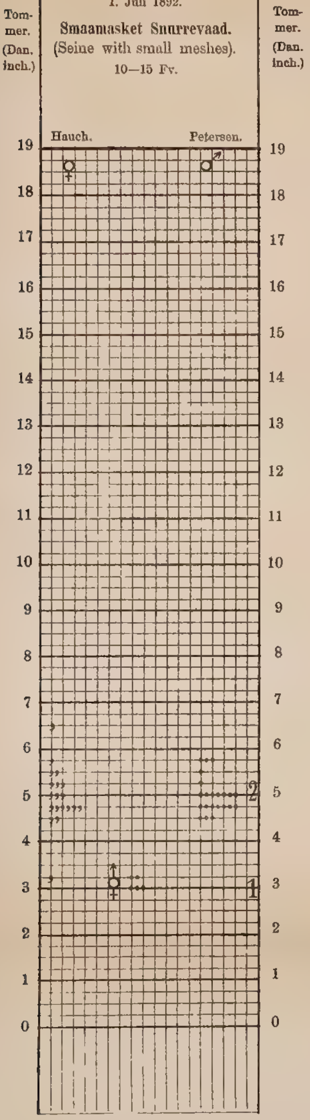
Tabel XVII.

Arnoglossus laterna.

N. V. for Kobbergrunden.

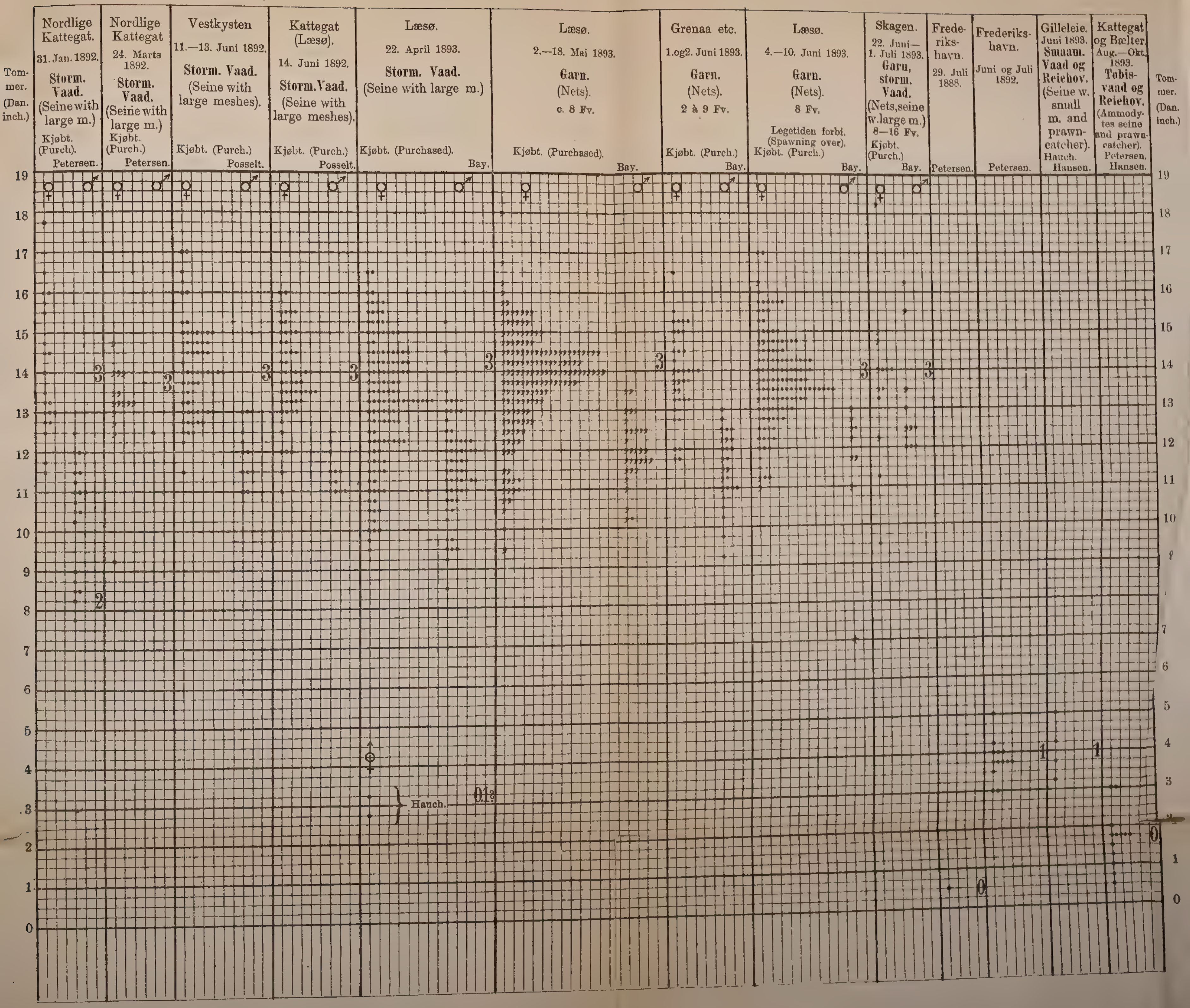
1. Juli 1892.

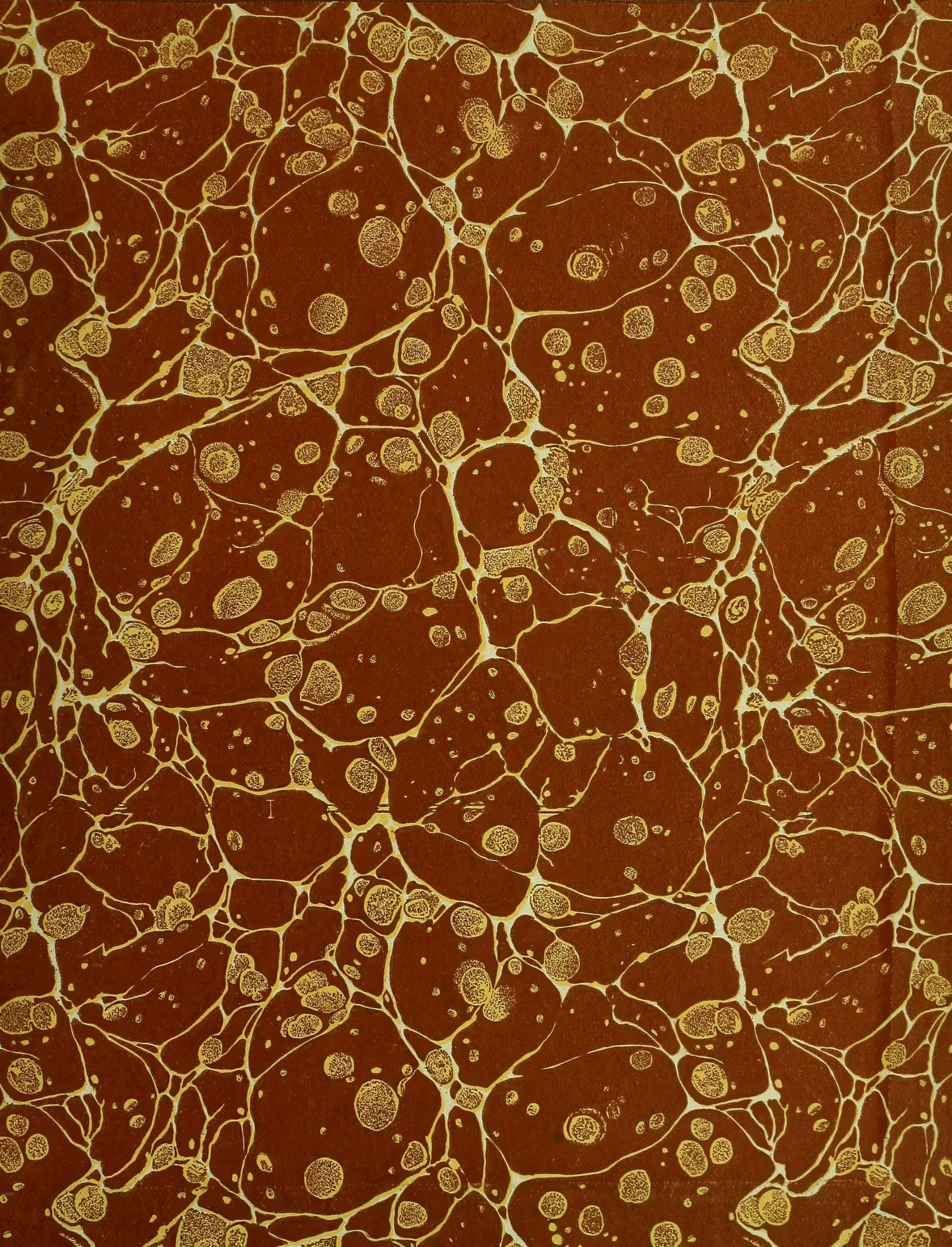
Smaamasket Snurrevaad.
(Seine with small meshes).
10—15 Fv.



Tabel XVIII.

Tungen. *(Solea vulgaris)*.





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